TITLE AND ABSTRACT OF HALF-HOUR TALKS

Speaker: Jim Davis

Title: Mapping tori of self-homotopy equivalences of lens spaces

Abstract: Jonathan Hillman, in his study of four-dimensional geometries, asked if every connected, closed four-manifold with Euler characteristic zero and fundamental group the semidirect product of an infinite cyclic group acting on a finite cyclic group is homotopy equivalent to the mapping torus of a self-isometry of a lens space.

Theorem: The answer is yes in the non-orientable case.

The proof involves rho invariants and surgery to study mapping tori of self-homotopy equivalences of three-dimensional lens spaces. A novel feature is the use of Gauss' Lemma used in his third, and most elementary proof of the law of quadratic reciprocity.

This is joint work with Shmuel Weinberger.

Speaker: Heiner Dovermann

Title: Algebraic Realization for Cyclic Group Actions

Abstract: An algebraic model for a closed smooth manifold M is a nonsigular real algebraic variety X that is diffeomorphic to M. We call X a strongly algebraic model if all vector bundles over X are strongly algebraic (classified, up to homotopy by entire rational maps). These concepts generalize to manifolds and vector bundles with compact Lie group action.

Conjecture: If G is a compact Lie group and M a closed smooth manifold. Then M has a strongly algebraic model.

We will summarize the history of the problem and previous results, and outline the proof of the conjecture for finite cyclic groups.

This is joint work with Arthur G. Wasserman.

Speaker: Ron Fintushel

Title: Some cyclic group actions on smooth 4-manifolds

Abstract: We will show how to construct topologically equivalent but smoothly inequivalent cyclic group actions on a simply connected smooth 4-manifold with non-trivial Seiberg-Witten invariants. More precisely:

Given a surface Σ of genus ≥ 1 in a simply connected smooth 4-manifold Y such that $\pi_1(Y - \Sigma) = \mathbb{Z}/p$, let X be the p-fold cyclic branched cover. There is an infinite family of smooth manifolds X_i all homeomorphic to X and with the same Seiberg-Witten invariant as X such that each X_i admits two smoothly distinct $\mathbb{Z}/p$-actions, but all these actions are topologically equivalent. (As long as X is spin and has nontrivial Seiberg-Witten invariant, the manifolds X_i will be irreducible.)

This is joint work with my PhD student, Nathan Sunukjian.

Speaker: Eduardo Gonzalez

Title: Gauged Gromov-Witten theory for Hamiltonian Manifolds

Abstract: Using the symplectic vortex equations introduced by D. Salamon, et. al. I will explain work in progress to define invariants for Hamiltonian group actions on symplectic manifolds and some applications. This is joint work with C.Woodward and some parts also with A. Ott, and F. Ziltener.

Speaker: Ian Hambleton
Title: Aspherical 2-complexes and 4-manifolds
Abstract: There is a rich class of finitely presented groups which occur as fundamental groups of aspherical 2-complexes. Examples include 1-relator groups (e.g. Baumslag-Solitar groups), small cancellation groups, and random groups in the sense of Gromov. In the talk I will give a survey of this area, and discuss the classification of topological 4-manifolds with such fundamental groups (joint work with Matthias Kreck and Peter Teichner).

Speaker: Bjoern Jahren
Title: Free involutions on $S^1 \times S^n$
Abstract: Topological free involutions on $S^1 \times S^n$ are classified up to conjugation. As a byproduct we obtain a new computation of the group of concordance classes of homeomorphisms of the projective space RP^n. This is joint work with Slawomir Kwasik.

Speaker: Hee Jung Kim
Title: Smooth surfaces with non-simply-connected complements
Abstract: This is joint work with Daniel Ruberman. We give two constructions of surfaces in simply-connected 4-manifolds with non simply-connected complements. One is an iteration of the twisted rim surgery introduced by the speaker. We also construct, for any group G satisfying some simple conditions, a simply-connected symplectic manifold containing a symplectic surface whose complement has fundamental group G. In each case, we produce infinitely many smoothly inequivalent surfaces that are equivalent up to smooth s-cobordism and hence are topologically equivalent for good groups.

Speaker: Jin Hong Kim
Title: Solvable automorphism groups of a compact Kahler manifold
Abstract: Let X be a compact Kahler manifold of complex dimension n. Let G be a connected solvable subgroup of the automorphism group Aut(X), and let N(G) be the normal subgroup of G of elements of null entropy. Recently Keum-Oguiso-Zhang posed an interesting conjecture, called the conjecture of Tits type, saying that G/N(G) is a free abelian group of rank less than or equal to n-1 and that the rank estimate is optimal. In this talk I want to discuss the conjecture of Tits type and some related questions.

Speaker: Yi Lin
Title: Cohomology of generalized complex quotients

Abstract: Generalized complex geometry was first introduced by N. Hitchin and then further developed by Gualtieri as a simultaneous generalization of both symplectic and complex geometries. A notion of generalized moment map and Hamiltonian action in generalized complex geometry was introduced by Tolman and the speaker a while ago. In this talk, we explain the Morse-Bott theory behind the geometry of generalized moment maps. In particular, this allows us to extend the whole Kirwan package in equivariant symplectic goemetry, i.e., the Kirwan surjectivity and injectivity results, to Hamiltonian torus actions on compact generalized complex manifolds. This talk is based on a recent joint work with T. Baird.

Speaker: Michael McCooey

Title: Which Groups Can Act on Four-manifolds? Results and Cohomological Methods

Abstract: We discuss various results restricting the classes of groups which can arise as homologically trivial, locally linear symmetries of four-manifolds:

(1) Previous work of Wilczynzki, Hambleton-Lee, and the speaker has shown that in many cases where linear model actions exist, the linear groups are the only groups which act.

(2) In the simply connected cases where obvious linear models do not exist, the only groups which can act are cyclic groups. (Such actions do indeed exist by work of Edmonds.)

(3) In the case of non-simply-connected manifolds, recent work of the speaker has shown that, with certain obvious exceptions, the only candidates for actions are cyclic groups, as well.

The fundamental tool behind most of these results is a comparison between the Borel equivariant cohomology of a given manifold and that of the singular set of an action. We review the basic constructions and tools, indicate the main differences between the linear model cases, the other simply-connected cases, and the non-simply-connected cases, and conclude with a brief discussion of current progress and open questions.

Speaker: Bill Meeks

Title: The theory of H-laminations and CMC foliations

Abstract: I will discuss some recent developments in the theory of embedded minimal and constant mean curvature hypersurfaces. One of these results is the Stable Limit Leaf Theorem whose proof I will give in the case of minimal laminations of 3-manifolds. I will cover several interesting applications of this result to the theory of H-laminations and CMC foliations. Some interesting consequences include the proof that a CMC foliation F of a 3-manifold N with bounded sectional curvature has a bound on the norm of the second fundamental form of its leaves that only depends on a bound of its absolute sectional curvature of N. This curvature estimate leads to sharp absolute mean curvature bounds of the leaves of the possible foliations. For example, in hyperbolic three space I will prove that this bound is 1. I will explain the classification of all weak CMC foliations of $\mathbb{R}^3$ with at most a closed countable set S of singularities by showing that all leaves are spheres and planes; in particular $|S| < 3$. This result leads to a topological result that a CMC foliation of a compact 3-manifold with a

finite number of non-degenerate singularities has an even number of singularities. For a homogeneously regular 5-manifold N of absolute sectional curvature at most 1, these results generalize to show that every codimension one CMC foliation of N has leaves with absolute mean curvature less than 2; this last mean curvature estimate depends in part on a classical result of Schoen-Simon-Yau on the classical Bernstein problem.

Speaker: Krzysztof Pawalowski
Title: Smooth circle actions on highly symmetric manifolds
Abstract: We construct for the first time smooth circle actions on highly symmetric manifolds such as disks, spheres, and Euclidean spaces which contain two points with the same isotropy subgroup whose representations determined on the tangent spaces at the two points are not isomorphic to each other. This allows us to answer negatively a question of W.-C. Hsiang and W.-Y. Hsiang [Some Problems in Differentiable Transformation Groups, Proceeding on of the Conference on Transformation Groups, New Orleans, 1967, Springer, Berlin, Problem 16, p. 228, 1968].

Speaker: Alvaro Pelayo
Title: Symplectic torus actions on 4-manifolds
Abstract: After reviewing the definition of symplectic manifold, symplectic action and some basic results on Hamiltonian torus actions, I will present a classification of symplectic actions of tori on (compact, connected) four-manifolds. The classification is in terms of a collection of invariants of the topology of the manifold, of the torus action and of the symplectic form. I will present explicit models of such symplectic manifolds with torus actions, defined in terms of these invariants. A stepping stone for this classification is the previous classification of symplectic torus actions with coisotropic principal orbits due to JJ Duistermaat and the speaker.

Speaker: Volker Puppe
Title: Involutions on 3-manifolds and self-dual, binary codes
Abstract: We study a correspondence between orientation reversing involutions on compact 3-manifolds with only isolated fixed points and self-dual, binary codes. We show in particular that every such code can be obtained from such an involution. We further relate doubly even codes to Pin^--structures and $Spin$-manifolds.
This is joint work with Matthias Kreck.

Speaker: Alessandra Sarti
Title: Automorphism Groups of K3 Surfaces
Abstract: I will present recent progress in the study of prime order automorphisms of K3 surfaces. An automorphism is called (non)symplectic if the induced operation on the global nowhere vanishing holomorphic two form is (non)trivial. After a short survey on the problem, I will describe the topological structure of the fixed locus, the geometry of these K3 surfaces and their moduli spaces.

Speaker: Nikolai Saveliev
Title: On real moduli spaces over M-curves

Abstract: Let F be a Riemann surface of genus 2, and $\sigma : F \to F$ a real structure with three fixed cirles. The pair (F, σ) is commonly referred to as an M-curve. The real structure σ gives rise to an involution σ^* on the moduli space $\mathcal{N}$ of stable holomorphic bundles $\mathcal{E} \to F$ of rank 2 with $c_1(\mathcal{E}) = 1$. The real moduli space $\mathcal{N}'$ is the fixed point set of σ^*. While the topology of $\mathcal{N}$ was thoroughly studied by Atiyah and Bott, the topology of $\mathcal{N}'$ largely remains a mystery : the best available description of $\mathcal{N}'$ as the intersection of two quadrics in the 5-dimensional real projective space has shed little light on its topology. We use techniques of Morse–Bott theory applied to a certain moment map $\mathcal{N} \to \mathbb{R}$ to compute integral cohomology of $\mathcal{N}'$.

This is joint work with Shuguang Wang.

Speaker: Dong Youp Suh

Title: Cohomological rigidity of quasitoric manifolds

Abstract: A quasi-toric manifold over an n-dimensional simple polytope P is a $2n$-dimensional real manifold M with an n-dimension torus $G = T^n = S^1 \times \cdots \times S^1$ action, which is locally isomorphic to the standard representation with a projection map $\pi \colon M \to P$ such that the fiber of π are the G orbits. Hence the orbit space M/G is homeomorphic to P. One of the interesting questions about quasitoric manifolds is whether quasitoric manifolds are cohomologically rigid, i.e., if two quasitoric manifolds have isomorphic cohomology rings then whether the two manifolds are homeomorphic?

In this talk we consider special kinds of quasitoric manifolds called generalized Bott towers and give some positive results on the cohomological rigidity question. In particular we show that any quasitoric manifold whose cohomology ring is isomorphic to that of a product of projective spaces is actually homeomorphic to the product of projective spaces.

This is a joint work with Suyoung Choi and Mikiya Masuda.

Speaker: Min Yan

Title: Functoriality in equivariant surgery

Abstract: The structure set of topological manifolds is functorial. Such periodicity may be extended to the equivariant setting as long as the maps preserve some equivariant monodromy data. Moreover, we also have such periodicity for the structure set relative to the non-free part, as long as some small gap condition is satisfied. This is joint work with Sylvain Cappel and Shmuel Weinberger.