Abstracts

Speaker: Mohammed Abouzaid, Columbia University
Date: Friday, 3/20/15
Time and location: 1:30pm, Jadwin A10
Title: Nearby Lagrangians are simply homotopic.

Abstract: This is a report on joint work in progress with T. Kragh, wherein we prove that a closed exact Lagrangian in a cotangent bundle is simply homotopy equivalent to the base. I will explain the two main ingredients of the proof: (i) realising the Whitehead torsion of the projection to the base as the torsion of a Floer theoretic map and (ii) using a large Hamiltonian deformation to deform the Floer complexes in such a way that this torsion can be shown to be trivial by an action filtration argument.

Speaker: Alejandro Adem, University of British Columbia
Date: Thursday, 3/19/15
Time and location: 9:45am, Jadwin A10
Title: An Infinite Loop Space Associated to Commuting Matrices.

Abstract: Let G denote a Lie group. We show that a construction introduced by Adem-Cohen-Torres built out of the commuting elements in G plays the role of a classifying space for commutativity. We will discuss how this is reflected in properties of these spaces and show that for the unitary group U we obtain a new infinite loop space. This leads to the notion of commutative K-theory, with characteristic classes computed using multisymmetric polynomials. This is joint work with Jos Manuel Gmez, John Lind and Ulrike Tillmann.

Speaker: Anton Ayzenberg, Osaka City University
Date: Wednesday, 3/18/15
Time and location: 11:00am, Jadwin A10
Title: Face enumeration in simplicial manifolds via toric topology.

Abstract: h-vector is the fundamental notion in the enumerative theory of simplicial complexes. The h-numbers of any triangulated $(n-1)$-sphere are nonnegative and satisfy the Dehn–Sommerville relations: $h_i = h_{n-i}$. This fact has a simple topological explanation. If we suppose for simplicity, that the sphere is dual to a simple polytope, then the Betti numbers of the corresponding toric variety, or quasitoric manifold, are exactly the h-numbers of a sphere. Thus the symmetry of h-numbers is just a manifestation of the Poincare duality on a suitable space.

For triangulated manifolds different from spheres, h-numbers lose the properties for which we love them: they may be negative and may fail to be symmetric. To remedy this deficiency, combinatorial algebraists invented h''-numbers. These are expressed in terms of h-numbers and Betti numbers of a simplicial manifold; they are nonnegative and satisfy the generalized Dehn–Sommerville relations: $h''_i = h''_{n-i}$. In my talk I will explain the topology which hides beyond this story.

Speaker: Agnès Beaudry, University of Chicago
Date: Thursday, 3/19/15
Time and location: 8:00PM, Fine Hall 214
Title: The Chromatic Splitting Conjecture.

Abstract: Understanding the homotopy groups of the sphere spectrum S is one of the great challenges of homotopy theory. The ring $\pi_* S$ is extremely complex; there is no hope of computing it completely. However, it carries an amazing amount of structure. A famous theorem of Hopkins and Ravenel states that, after localizing at a prime, the sphere spectrum is filtered by "simpler" spectra called the chromatic layers, which we denote by $L_n S$. How these layers interact with each other is a mystery. A conjecture of Hopkins, the chromatic splitting conjecture, suggests an answer to the problem. The difficulty of the problem grows fast with n, and varies with the choice of prime at which we localize. The chromatic splitting conjecture is known to hold in its strongest form at all primes p when $n = 1$, and at all odd primes when $n = 2$. However, it does not hold when $p = n = 2$. In this talk, I explain why it fails in this case.

Speaker: Suyoung Choi, Ajou University
Date: Thursday, 3/19/15
Time and location: 8:40PM, Fine Hall 214
Title: Construction of a small cover with odd torsion.

Abstract: In this talk, we discuss an explicit construction of a small cover having odd torsion in its cohomology. Let K be a simplicial sphere with m vertices. For a given real toric space M over K and a positive integer tuple $J \in \mathbb{N}^m$, one can find a canonical toric space, denoted by $M(J)$, over $K(J)$. By studying the cohomology of $M(J)$, we shall give a simple construction of a small cover with odd torsion. This work is jointly with Hanchul Park (KIAS).

Speaker: Daniel Cristofaro-Gardiner, Harvard University
Date: Saturday, 3/19/15
Time and location: 1:30PM, Jadwin A10
Title: Symplectic embeddings of four-dimensional toric domains.

Abstract: While much is known about symplectic embeddings of four-dimensional ellipsoids and polydiscs, symplectic embeddings of other domains are in general poorly understood. I will survey some recent progress concerning symplectic embeddings of four-dimensional toric domains. It turns out that in many cases, Hutchings embedded contact homology capacities give sharp obstructions. Moreover, these invariants can be computed purely combinatorially, and are related to interesting lattice point enumeration problems. Some of this is joint work with M. Hutchings, R. Stanley, and others.

Speaker: Michael Davis, University of Ohio
Date: Saturday, 3/21/15
Time and location: 9:45AM, Jadwin A10
Title: The action dimension of RAAGs.

Abstract: This is a report on joint work with Grigori Avramidi, Boris Okun and Kevin Schreve. The "action dimension" of a discrete group G is the smallest dimension of a contractible manifold which admits a proper action of G. Associated to any flag complex L there is a right-angled Artin group, A_L. We compute the action dimension of A_L for many L. Our calculations come close to confirming the conjecture that if the L^2-Betti number of A_L in degree l is nonzero, then the action dimension of A_L is greater than or equal to $2l$.

Speaker: Jesus Gonzalez, CINVESTAV
Date: Friday, 3/20/15
Time and location: 5:45PM, Jadwin A10
Title: SAM GITLER: HIS WORK AND LEGACY.

Abstract: This talk will survey some of the high points in Sam Gitler's mathematical work and how it has shaped modern algebraic topology.

Speaker: Yael Karshon, University of Toronto
Date: Saturday, 3/21/15
Time and location: 4:45PM, Jadwin A10
Title: COMPLETELY INTEGRABLE TORUS ACTIONS ON COMPLEX MANIFOLDS WITH FIXED POINTS.

Abstract: We show that if a holomorphic n dimensional compact torus action on a compact connected complex manifold of complex dimension n has a fixed point then the manifold is equivariantly biholomorphic to a smooth toric variety. This is joint work with Hiroaki Ishida.

Speaker: Nicholas Kuhn, University of Virginia
Date: Thursday, 3/19/15
Time and location: 1:30PM, Jadwin A10
Title: THE MOD p HUREWICZ MAP FOR INFINITE LOOPSPACES: THEOREMS, EXAMPLES, AND CONJECTURES.

Abstract: In a 1958 paper, Milnor observed that then new work by Bott allowed him to determine which spheres admit a vector bundle with non-trivial top Stiefel-Whitney class. This can be interpreted as a calculation of the mod 2 Hurewicz map for the classifying space BO. The infinite loopspace BO is the 0th space of a spectrum bo, so this Hurewicz map fits the form:

$$h : \pi_*(b) \longrightarrow H_*(B; \mathbb{Z}/p),$$

where B is the 0th space of a spectrum b. I have been studying such Hurewicz maps for generalized homology theories by relating the Adams filtration of the domain to a filtration of the range coming from Andre-Quillen homotopy calculus. When specialized to ordinary mod p homology, my general results have some tidy consequences. As one application, one learns that if the mod p cohomology of a connected spectrum b is a finitely presented module over the Steenrod algebra, the image of the Hurewicz map in $H_*(B; \mathbb{Z}/p)$ will be finite dimensional. As another application, one can immediately read off Milnor's theorem from a quick glance at the standard Adams spectral sequence chart for bo. It is not much harder to deduce the analogous calculation for tmf, the connected cover of the spectrum of topological modular forms: the mod 2 Hurewicz map of its 0th space has image that is five dimensional.

Speaker: Shintaro Kuroki, University of Tokyo
Date: Thursday, 3/19/15
Time and location: 8:00PM, Fine Hall 110
Title: A NECESSARY AND SUFFICIENT CONDITION FOR THE EXTENSION OF AXIAL FUNCTIONS OF GKM GRAPHS.

Abstract: A necessary and sufficient condition for the extension of axial functions of GKM graphs Abstract: An (m,n)-type GKM graph $(\Gamma, \mathcal{A})$ is defined as an m-valent graph Γ with a label on edges, called an axial function $\mathcal{A} : E(\Gamma) \to H^2(BT^n)$, where $n \leq m$. This notion was introduced by Guillemin and Zara as a combinatorial counter part of a manifold with a torus action which satisfies some nice conditions, called GKM manifolds (GKM stands for the initials of Goresky-Kottwitz-MacPherson). For example, toric manifolds or homogeneous spaces G/H of maximal rank subgroup H in G are GKM manifolds. GKM graph is very useful tool to compute equivariant invariants of GKM manifolds such as equivariant cohomology. In this talk, I will introduce a new application of GKM graphs to geometry. More precisely, I will define a free Z-module $\mathcal{O}(\Gamma, \mathcal{A})$ for an (m, n)-type GKM graph $(\Gamma, \mathcal{A})$ and show that its rank gives a necessarily and sufficient condition for the extension of this (m, n)-type GKM graph $(\Gamma, \mathcal{A})$ to an (m, l)-type GKM graph, where $n \leq l \leq m$. This result can be applied to see for example the diagonal T^n-action on the flag manifold $U(n+1)/T^{n+1}$ is the maximal effective torus action (remark that the diagonal T^{n+1}-action is not effective).

Speaker: Santiago López de Medrano, UNAM
Date: Friday, 3/20/15
Time and location: 9:45AM, Jadwin A10
Title: INTERSECTIONS OF QUADRICS, OLD AND NEW or HOW SAM CHANGED MY LIFE.

Abstract: Consider $F : \boldsymbol{R}^n \to \boldsymbol{R}^k$ given by k quadratic forms and the varieties $V = F^{-1}(0)$ and $Z = V \cap S^{n-1}$. In 1984 I described the topology of the generic Z when the quadratic forms are simultaneously diagonalizable and $k = 2$, but it took some time to fill-in the details of a long proof that also left a few cases open. The main unsolved questions (to extend the result to the non-diagonal case and for $k > 2$), looked hopelessly difficult.

In fact, not much progress was made on the topology of these varieties until 2002, when Frédéric Bosio and Laurent Meersseman opened many new roads for the case $k > 2$ and raised new questions and an interesting conjecture. But I had no idea on how to attack those problems.

In 2007 everything changed for me: a talk by Sam made me realize that these varieties were special cases of a construction called the *polyhedral product functor*. In 2008, we started to work together and (combining Sam's global functorial picture with my concrete knowledge of the varieties) we proved the Bosio-Meersseman conjecture and soon after we answered some more of their questions, thus describing a wide (but necessarily partial) region of the $k > 2$ case. Having opened the gates, a veritable tsunami of results followed: in a few years I solved with other collaborators the rest of the problems and cases left open in 1984 and some new ones.

And it has not stopped: recent work on the projectivizations of those varieties and on a family of them with dihedral symmetry has run into difficulties, but on the singular ones another 30 year old question has been solved.

Speaker: Mikiya Masuda, Osaka City University
Date: Saturday, 3/21/15
Time and location: 2:45PM, Jadwin A10
Title: COHOMOLOGY OF REGULAR HESSENBERG VARIETIES AND REPRESENTATIONS OF SYMMETRIC GROUPS.

Abstract: Hessenberg varieties $Hess(X,h)$ are subvarieties of the flag variety $Flag(\mathbb{C}^n)$ defined by two parameters: a linear operator X on $\mathbb{C}^n$ and a Hessenberg function $h\colon [n] \to [n]$. $Hess(X,h)$ is called *regular nilpotent* when X is nilpotent of full rank and *regular semisimple* when X is semisimple with distinct eigenvalues. The class of regular nilpotent Hessenberg varieties contains Peterson varieties while the class of regular semisimple Hessenberg varieties contains the toric varieties associated with Weyl chambers of type A.

In this talk, we will discuss the cohomology ring of a regular nilpotent Hessenberg variety and its relation to the cohomology ring of a regular semisimple Hessenberg variety (with a common h) in terms of representations of the symmetric group $\mathfrak{S}_n$. If time permits, I will explain its relation to the chromatic symmetric function of a graph associated with h (Shareshian-Wachs conjecture). This is a joint work with Hiraku Abe, Megumi Harada and Tatsuya Horiguchi.

Speaker: Haynes Miller, MIT
Date: Thursday, 3/19/15
Time and location: 4:45PM, Jadwin A10
Title: SOME LOCAL COMPUTATIONS IN HOMOTOPY THEORY.

Abstract: In 1972 Rafe Zahler noted that complex bordism thinks that the Hopf map eta is non-nilpotent, and asked what the eta-localization of the Novikov E_2-term was. Some forty years later, Isaksen and Guillou asked the analogous question about motivic homotopy groups over the complex numbers, where also eta is non-nilpotent. I will describe joint work with Michael Andrews in which both questions are resolved.

Speaker: Jeremy Miller, Stanford University
Date: Wednesday, 3/18/15
Time and location: 9:45AM, Jadwin A10
Title: A GENERALIZATION OF NON-ABELIAN POINCARÉ DUALITY.

Abstract: Salvatore and Lurie's non-abelian Poincaré duality theorem equates the topological chiral homology of a group-like En-algebra with a space of sections of a certain bundle. I will describe how to generalize non-abelian Poincaré duality to the case of En-algebras which are not group-like. While non-abelian Poincaré duality for group-like En-algebras can be viewed as the minimal theorem simultaneously generalizing Poincaré duality and Mays recognition principle for iterated loop spaces, this generalization can be viewed as the minimal generalization of the group-completion theorem and McDuffs scanning result for configuration spaces of unordered particles in an open manifold.

Speaker: Fatemeh Mohammadi, Institute of Science and Technology, Austria
Date: Thursday, 3/19/15
Time and location: 8:40PM, Fine Hall 110
Title: DIVISORS ON GRAPHS, ORIENTATIONS, SYZYGIES, AND SYSTEM RELIABILITY.

Abstract: Attached to any finite graph G, there is a canonical ideal I_G which encodes the linear equivalences of divisors on G. There is also a natural lattice (the "lattice of integral cuts") whose Delaunay cell decomposition is related to graphic hyperplane arrangements and the ideal I_G. We use ideas from potential theory on graphs and from the theory of Delaunay decompositions for lattices to read the Betti numbers of I_G in terms of the number of faces of various dimensions in the graphic hyperplane arrangement, or equivalently, the number of orbits of the Delaunay cells of various dimensions in the cut lattice. These interpretations also imply that Betti numbers can be read from the number of acyclic partial orientations of G. The ideal I_G is also appearing in the theory of system reliability, and its Hilbert series encodes the reliability of the system which is the probability that G is connected (assuming that the vertices are reliable but each edge may fail with the probability p_e). If time permits I will also describe generalizations to regular matroids.

The first part of the talk is based on the joint work with Farbod Shokrieh.

Speaker: Taras Panov, Moscow State University
Date: Thursday, 3/19/15
Time and location: 2:45PM, Jadwin A10
Title: ON TORIC GENERATORS IN THE UNITARY AND SPECIAL UNITARY BORDISM RINGS.

Abstract: We construct a new family of toric manifolds generating the unitary bordism ring. Each manifold in the family is the complex projectivisation of the sum of a line bundle and a trivial bundle over a complex projective space. We also construct a family of special unitary quasitoric manifolds which contains polynomial generators of the special unitary bordism ring with 2 inverted in dimensions ¿8. Each manifold in the latter family is obtained from an iterated complex projectivisation of a sum of line bundles by amending the complex structure to get the first Chern class vanishing.

This is a joint work with Zhi Lu (Fudan University).

Speaker: Ana Rita Pires, Fordham University
Date: Thursday, 3/19/15
Time and location: 9:20PM, Fine Hall 110
Title: THE TOPOLOGY OF TORIC ORIGAMI MANIFOLDS.

Abstract: The topology of a toric symplectic manifold can be read directly from its orbit space (a.k.a. moment polytope), and much the same is true of the (smooth) topological generalizations of toric symplectic manifolds and projective toric varieties. An origami manifold is a manifold endowed with a closed 2-form with a very mild degeneracy along a hypersurface, but this degeneracy is enough to allow for non-simply-connected and non-orientable manifolds, which are excluded from the topological generalizations mentioned above. In this talk we will see how the topology of an (orientable) toric origami manifold, in particular its fundamental group, can be read from the polytope-like object that represents its orbit space. These results are from joint work with Tara Holm.

Speaker: Mainak Poddar, Universidad de los Andes
Date: Thursday, 3/19/15
Time and location: 9:20PM, Fine Hall 214
Title: TORIC PRINCIPAL BUNDLES.

Abstract: Kaneyama and then Klyachko developed two approaches to studying torus equivariant (algebraic) vector bundles on toric varieties. We find suitable generalizations of these approaches to classify (holomorphic/algebraic) equivariant principal bundles on toric varieties. This is joint work with Indranil Biswas and Arijit Dey.

Speaker: Doug Ravenel, University of Rochester
Date: Saturday, 3/21/15
Time and location: 11:00AM, Jadwin A10
Title: INSIDE THE PROOF OF THE KERVAIRE INVARIANT THEOREM or HOW I GOT BITTEN BY THE EQUIVARIANT BUG.

Abstract: This talk will cover one aspect of the proof of the Kervaire invariant theorem (proved with Hill and Hopkins), namely the gap theorem. It says that π_{-2} of a certain spectrum Ω vanishes. It is the part of the paper that requires equivariant methods not available before 2009. It turns out that once the machinery has been set up, it follows from a surprisingly easy calculation.

Speaker: Jongbaek Song, KAIST
Date: Thursday, 3/19/15
Time and location: 10:00AM, Fine Hall 110
Title: TORSIONS AND ODD DEGREE COHOMOLOGY OF TORIC ORBIFOLDS.

Abstract: It is well-known that the integral cohomology ring of smooth toric variety is concentrated in even degrees and torsion free. However, this does not hold for singular toric varieties. For example, integral cohomology ring of fake weighted projective spaces have torsions in odd degrees. In this talk, we discuss a necessarily condition for vanishing odd degree cohomology and torsion freeness of singular toric varieties. This is a joint work with Anthony Bahri, Nigel Ray, and Soumen Sarkar.

Speaker: Don Stanley, University of Regina
Date: Thursday, 3/19/15
Time and location: 10:00PM, Fine Hall 214
Title: CONFIGURATION SPACES SINCE BENDERSKY-GITLER.

Abstract: Let M be a closed manifold and $F(M,k)$ the ordered configuration space of k points in M. In their first joint paper Bendersky and Gitler give a chain complex that computes the rational cohomology of $F(M,k)$ as a vector space. We discuss subsequent developments on the problem of finding the algebra and other more refined structures. We end by giving a model for the rational homotopy type of $F(M,3)$ when M is 4-connected. The new research part of the talk is joint work with Pascal Lambrechts.

Speaker: Dong Youp Suh, KAIST
Date: Wednesday, 3/18/15
Time and location: 4:45AM, Jadwin A10
Title: Symplectic capacities from Hamiltonian Circle Actions.

Abstract: The lower bound of the Gromov width can be obtained by actual construction of symplectic embeddings of balls into the manifold following a work by Karshon-Tolman. On the other hand by a work of Gromov, the upper bound of the Gromov width can obtained by finding a certain nonzero Gromov-Witten invariant. In oder to find nonzero Gromov-Witten invariant, we study the Seidel element in the quantum cohomology ring of M as is studied in a work of McDuff-Tolman.

The Gromov width is an example of a more general notion called the symplectic capacity. We compute another symplectic capacity, called Hofer-Zehnder capacity of a closed Fano symplectic manifold with a semifree Hamiltonian circle action with a single maximum point using the similar method.

Speaker: Rob Thompson, Hunter College and the Graduate Center, CUNY
Date: Wednesday, 3/18/15
Time and location: 2:45PM, Jadwin A10
Title: An unstable change of rings for Morava E-theory.

Abstract: The Bousfield-Kan (or unstable Adams) spectral sequence can be constructed for various homology theories such as Brown-Peterson homology theory BP, Johnson-Wilson theory $E(n)$, or Morava E-theory E_n. For nice spaces the E_2-term is given by Ext in a category of unstable comodules. We establish an unstable Morava change of rings isomorphism between $\mathrm{Ext}_{\mathcal{U}_{BP_*BP}}(BP_*, M)$ and $\mathrm{Ext}_{\mathcal{U}_{E_{n*}E_n}}(E_{n*}, E_{n*} \otimes_{BP_*} M)$ for unstable BP_*BP-comodules that are v_n-local and satisfy $I_nM = 0$. We show that the latter can be interpreted as Ext in the category of comodules over a certain bialgebra. Implications for the convergence of the Bousfield-Kan spectral sequence will be considered.

Speaker: Susan Tolman, Urbana
Date: Friday, 3/20/15
Time and location: 2:45PM, Jadwin A10
Title: Non-Hamiltonian actions with isolated fixed points.

Abstract: Let a circle act symplectically on a closed symplectic manifold M. If the action is Hamiltonian, we can pass to the reduced space; moreover, the fixed set largely determines the cohomology and Chern classes of M. In particular, symplectic circle actions with no fixed points are never Hamiltonian. This leads to the following important question: What conditions force a symplectic action with fixed points to be Hamiltonian? Frankel proved that Kahler circle actions with fixed points on Kahler manifolds are always Hamiltonian. In contrast, McDuff constructed a non-Hamiltonian symplectic circle action with fixed tori. Despite significant additional research, the following question is still open: Does there exists a non-Hamiltonian symplectic circle action with isolated fixed points? The main goal of this talk is to answer this question by constructing a non-Hamiltonian symplectic circle action with exactly 32 fixed points on a closed six-dimensional symplectic manifold. In part, joint with Jordan Watts.

Speaker: Michael Wiemeler, Universität Augsburg
Date: Wednesday, 3/18/15
Time and location: 2:45PM, Jadwin A10
Title: Invariant metrics of positive scalar curvature on S^1-manifolds.

Abstract: In this talk we will discuss the construction of invariant metrics of positive scalar curvature on manifolds M with circle actions. We will discuss two cases. First the case where there is a fixed point component of codimension two. Then there is always an invariant metric of positive scalar curvature on M. The case where the fixed point set has codimension at least four is more complicated. In this case the answer to the question if there is an invariant metric of positive scalar curvature on M depends on the class of M in a certain equivariant bordism group. We will discuss the case, where the maximal stratum of M is simply connected and all normal bundles to the singular strata are complex vector bundles, in more detail. In this case there is an $l \in \mathbb{N}$ such that the equivariant connected sum of 2^l copies of M admits an invariant metric of positive scalar curvature if and only if a $\mathbb{Z}[\frac{1}{2}]$-valued bordism invariant of M vanishes.

Speaker: Gareth Williams, Open University
Date: Thursday, 3/19/15
Time and location: 11:00AM, Jadwin A10
Title: Weighted projective spaces, equivariant K-theory and piecewise algebra.

Abstract: Weighted projective spaces are interesting through many lenses: for example, as natural generalisations of ordinary projective spaces, as toric varieties and as orbifolds. From the point of view of algebraic topology, it is natural to study their algebraic topological invariants – notably, their (equivariant) cohomology rings. Recent work has provided satisfying qualitative descriptions for these rings, in terms of piecewise algebra, for various cohomology theories.

This talk, written for an audience with varied mathematical interests, will introduce weighted projective spaces as toric varieties and survey results on their (equivariant) cohomology rings, with particular focus on equivariant K-theory. It will conclude with recent results of Megumi Harada, Tara Holm, Nige Ray and the speaker.

Speaker: W. Stephen Wilson, Johns Hopkins University
Date: Friday, 3/20/15
Time and location: 11:00AM, Jadwin A10
Title: On the work of Martin Bendersky.

Abstract: The Lecture will be about the work of Martin Bendersky.