Topology
(Org: **A. Adem** (UBC), **J. Gonzalez** (CINVESTAV), **I. Hambleton** (McMaster) and **D. Juan** (UNAM-Morelia))

ALEJANDRO ADEM, University of British Columbia
Commuting and non-commuting n-tuples in a Lie group

In this talk I will describe joint work with Fred Cohen on the geometry of the space of ordered commuting and non-commuting n-tuples in a Lie group G.

SERGEY ANTONYAN, Universidad Nacional Autónoma de México, Departamento de Matemáticas, Facultad de Ciencias, Ciudad Universitaria, 04510 México D.F.
Banach–Mazur compacta: Results and Problems

In his 1932 book *Théorie des Opérations Linéaires*, S. Banach introduced the space of isometry classes $[X]$, of n-dimensional Banach spaces equipped with the famous Banach–Mazur metric:

$$d([X],[Y]) = \ln \inf\big\{\|T\| \cdot \|T^{-1}\| \;\big|\; T\colon X \to Y \text{ is a linear isomorphism}\big\}.$$

These spaces are now denoted by $BM(n)$ and called the Banach–Mazur compacta.

In this talk we shall present some resent results and open problems related to these interesting objects.

JOSE LUIS CISNEROS, Instituto de Matemáticas, UNAM, Unidad Cuernavaca, Av. Universidad s/n, Col. Lomas de Chamilpa, Cuernavaca Morelos, México
Characteristic classes and transversality

Let ξ be a smooth vector bundle over a differentiable manifold M. Let $h\colon \varepsilon^{n-i+1} \to \xi$ be a generic bundle morphism from the trivial bundle of rank $n-i+1$ to ξ. We give a geometric construction of the Stiefel–Whitney classes when ξ is a real vector bundle, and of the Chern classes when ξ is a complex vector bundle. Using h we define a differentiable closed manifold $\tilde{Z}(h)$ and a map $\phi\colon \tilde{Z}(h) \to M$ whose image is the singular set of h. The i-th characteristic class of ξ is the Poincaré dual of the image, under the homomorphism induced in homology by ϕ, of the fundamental class of the manifold $\tilde{Z}(h)$. We extend this definition for vector bundles over a paracompact space, using that the universal bundle is filtered by smooth vector bundles.

SAMUEL GITLER, Centro de Investigación del IPN
Moment angle complexes

Moment angle complexes are universal for toric varieties. There is a free action of a torus so that the quotient by this action gives you a toric manifold. We determine the stable structure of the moment angle complexes and their generalizations.

JESUS GONZALEZ, CINVESTAV, A.P. 14-740, Mexico City, 07000
Formal groups and BP-homology of finite abelian groups of rank two

In their study of differential periodic transformations, Conner and Floyd realized the importance of understanding the global structure of manifolds admitting a group action without stationary points. They succeeded in giving a homotopy characterization, but could only determine the corresponding bordism ideal for the case of a finite elementary abelian p-group of rank two

(soon after the general rank case was completed by Floyd). In this talk I address the (2-primary) "non-elementary" situation. Much of the information is derived through a sharp description of the (simultaneous) 2- and v_1-divisibility properties of 2-typical formal groups. Although the geometric motivation is no longer valid, I discuss some applications to the motion planning and immersion problems for 2-torsion lens spaces.

This is joint work with Leticia Zárate.

IAN HAMBLETON, McMaster University
Free actions on products of spheres

Which finite groups can act freely and smoothly on a product $S^n \times S^n$ of two spheres? This talk will describe an approach to solving this problem (joint work with Özgün Ünlü). Important test cases are the non-abelian p-groups of order p^3 and exponent p, for p an odd prime.

RICHARD KANE, University of Western Ontario
Torsion and Lie Groups

The rational cohomology of a compact connected Lie group G can be expressed and explicitly determined using invariant theory. One need only determine the rational cohomology of BG, the classifying space of G, and that can be expressed as a ring of invariants determined by the action of the Weyl group W (associated to G) on the rational cohomology of BT, the classifying space of any maximal torus $T < G$.

When one moves to $\mathrm{mod}\, p$ cohomology the same pattern holds unless the group G has p torsion in its integral cohomology. In the torsion case one needs new tools and a new pattern. We will explore the use of the generalized invariants, as defined by Kac and Peterson, to address this question for both algebra and coalgebra structures.

KEE LAM, University of British Columbia, Vancouver, BC, Canada
On Yuzvinsky's conjecture arising from the study of sums of squares

An intercalate matrix M of type (r, s, n) is an r by s matrix each entry of which is colored by one of n given colors such that

(i) the colors along each row are mutually distinct, and likewise along each column,

(ii) any 2 by 2 submatrix of M contains either 2 colors or 4 colors.

Historically, interest in such matrices dated back to the classical work of Hurwitz and Radon on identities involving sums of squares. Let F be the field of 2 elements and P be the truncated polynomial ring $F[u, v]/(u^r, v^s)$, where (u^r, v^s) denotes the ideal generated by the r-th power of u and the s-th power of v. Let ros denote the "height" (or nilpotency) of $u + v$ as an element in P. It was conjectured by S. Yuzvinsky that the number of colors required to make an r by s matrix intercalate must be at least ros. In this talk I will give a proof to some special cases of this conjecture. While combinatorial in content, the proof is suggested by, and is closely analogous to, ideas from topology and geometry. Bringing out such analogy as clearly as possible will be the main objective of my talk.

ERNESTO LUPERCIO, Cinvestav, IPN, México
Orbifold String Topology

In their seminal paper Chas and Sullivan introduced a new structure in the homology (and equivariant homology) of the free loop space of a smooth manifold. This structure behaves in many ways as a quantum field theory. For an algebraic topologist

this has an expression as certain algebraic structures (BV-algebras, Lie algebras, operad actions). In this talk we will introduce the basic ideas in this field, and then explain our generalization (jointly with B. Uribe and M. Xicotencatl) to the case in which the manifold is replaced by an orbifold. An orbifold has an atlas which locally looks like an open set of euclidean space with the action of a finite group. Our generalization could be interpreted as an equivariant version of the theory.

GRIGORY MIKHALKIN, University of Toronto
Tropical intersection theory

Tropical varieties are finite-dimensional polyhedral complexes which are in general not topological manifolds. However, it is possible to define cycles and the cycle intersections there. We plan to discuss these definitions as well as the tropical counterparts of $h^{p,q}$.

JACOB MOSTOVOY, Instituto de Matemáticas (Cuernavaca), Universidad Nacional Autónoma de México
Moduli spaces of real curves

I will discuss various definitions of the moduli spaces of real algebraic curves.

ERIK PEDERSEN, Binghamton University, Binghamton, NY 13602-6000, USA
Manifolds and p-compact groups

We prove that every p-compact group is the p-completion of a smooth closed parallellisable manifold.

Joint work with Tilman Bauer.

DANIEL JUAN PINEDA, UNAM–Morelia, UNAM–Campus Morelia
The Fibered Isomorphism Conjecture for braid groups

We will describe the Fibered Isomorphism Conjecture (FIC) of Farrell and Jones and show that the braid groups of the 2-dimensional sphere and the 2-dimensional real projective space in any number of strings satisfy FIC. We will present consequences of this fact in the computation of Whitehead group of the above groups.

JOSE SEADE, Universidad Nacional Autónoma de México
Open books and real analytic germs

Milnor's fibration theorem for complex singularities says that every holomorphic map $C^n \to C$ determines canonically an open book decomposition on the $2n-1$ sphere. This result has given rise to a vast literature, both in singularity theory and in knot theory.

In this talk I will present a recent work with Anne Pichon, where we extend Milnor's theorem to meromorphic germs and to certain real analytic mappings.

ENRIQUE TORRES-GIESE, UBC
Topology of Spaces of Homomorphisms

We will discuss basic geometric and homotopical properties of the space of homomorphisms $\mathrm{Hom}(\Gamma, G)$ when Γ is a suitable discrete group and G is a Lie group.

MIGUEL XICOTENCATL, Mathematics Department, CINVESTAV, Ave. IPN 2508, Mexico City, 07360
The loop orbifold of the symmetric product

By using the loop orbifold of the symmetric product, we give a formula for the Poincaré polynomial of the free loop space of the Borel construction of the symmetric product. We also show that the Chas–Sullivan product in the homology of the free loop space of the Borel construction induces a ring structure in the homology of the inertia orbifold of the symmetric product. This ring structure is compared to the one in cohomology through Poincaré duality.