Sixth European Congress of Mathematics

Kraków, Poland

Satellite Thematic Session

in

Homotopy Theory

Sunday-Wednesday, July 1-4, 2012

Talks on **Sunday** will be held in Large Hall B (level 0-3) of the Auditorium Maximum of the Jagiellonian University, Krupnicza street 33, Kraków.

Talks on **Monday-Wednesday** will be held in Grand Hall U2 (level 0) of the AGH University of Science and Technology, Reymonta Street 7, Kraków.

PROGRAM:

Sunday, July 1, 2012: **Large Hall B, Jagiellonian University:**

10:30-11:20 Marek Golasiński (Nicholas Copernicus University, Torun)
"Free and properly discontinuous actions of discrete groups" on homotopy circles"

Let $G \times \Sigma(1) \to \Sigma(1)$ be a free, properly discontinuous and cellular action of a group G on a finite dimensional CW-complex $\Sigma(1)$ that has the homotopy type of the circle. We determine all virtually cyclic groups G that act on $\Sigma(1)$ together with the induced action $G \to \mathrm{Aut}(H^1(\Sigma(1), \mathbb{Z}))$, and we classify the orbit spaces $\Sigma(1)/G$. Then, we study the same questions for certain families of groups. Joint work with D.L. Gonçalves and R. Jiménez.

11:30-12:20 Martin Markl (Czech Academy of Science)
"The biassociahedron"

We give a simple description of the face poset of the biassociahedra that generalizes, in a straightforward and natural manner, the description of the faces of the Stasheff's associatiahedra via planar trees.

12:20-13:40 Lunch

13:40-14:30 Jesper Grodal (University of Copenhagen)
"F-isomorphism in group cohomology implies p-fusion isomorphism, when p is odd"

I will report on recent joint work with Dave Benson and Ellen Henke, where we prove that if a map $H \to G$ between finite groups with the same Sylow p-subgroup induces an F-isomorphism in mod p cohomology, then H controls p-fusion in G, when p is odd. This generalizes classical results of Quillen, who proved this when H is the Sylow p-subgroup.

Our results also generalize a celebrated result of Mislin, and our methods in fact provide a comparatively simple algebraic proof of his theorem, when p is odd. In my talk, I'll also discuss a $p = 2$ version, where we get a similar conclusion at the expense of using higher chromatic cohomology theories instead of mod p cohomology.

14:40-15:30 Dietrich Notbohm (Vrije Universiteit, Amsterdam)
"Almost complex structures on quasi toric manifolds"

Quasi toric manifolds are the topological version of smooth toric varieties, but in general do not carry a complex structure. The next what you can hope for is whether their tangent bundles can be given the structure of a complex vector bundle. We will discuss this question in the equivariant case, i..e. with respect to the associated torus action.

15:30-16:00 Break

16:00-16:50 Carles Casacuberta (University of Barcelona)
"Cohomological localizations exist if supercompact cardinals exist"

It is known that the existence of cohomological localizations of spaces or spectra can be proved assuming the existence of sufficiently large cardinals. In this talk we prove that supercompact cardinals are sufficiently large. The proof is based on the fact that classes of cohomological acyclics are Σ_2 in the sense of Lévy complexity, while classes of homological acyclics are Σ_1, and therefore homological localizations exist in ZFC, as is well known. We also show how to construct cohomological localizations using Dror-Dwyer long towers, assuming existence.

Part of this is joint work with J. Bagaria, A. Mathias and J. Rosický, and another part with I. Gálvez.

17:00-17:30 Matan Prezma (Ben-Gurion University)
"Homotopy normal maps"

A group property made homotopical is a property of the corresponding classifying space. This train of thought leads to the definition of homotopy normal maps between loop spaces being loop maps $N \to G$ for which $BN \to BG$ is the inclusion of the homotopy kernel (i.e. homotopy fiber) of some map $BG \to W$ with W a connected space. A homotopy normal map is a homotopical analogue to the inclusion of a normal subgroup in that it induces a topological group structure on the homotopy quotient $G//N := EN \times_N G$ and a group map structure on $G \to G//N$.

We characterize these maps using a notion of a homotopy action of a loop space on a space which is a "relative" version of reduced Segal space and deduce that homotopy normal maps are invariant under homotopy monoidal endofunctors of spaces, e.g. localizations and completions.

MONDAY, JULY 2, 2012: **Grand Hall U2, AGH U. Science & Technology:**

16:30-17:20 Anicetto Murillo (Universidad de Malaga)
"Algebraic models of non connected spaces via the Lawrence-Sullivan construction"

Having in mind the algebraic description of the rational homotopy type of non connected space, we construct a detailed homotopy theory of L-infinity algebras based in the Lawrence-Sullivan construction, a complete differencial Lie algebra which becomes the right cylinder in this new framework.

17:30-18:20 Volodymyr Sharko (National Academy of Sciences, Ukraine)
"Crossed complexes and application"

Non-commutative algebraic topology investigate non-simply connected CW-comlexes. An important tool here is a crossed modules. The purpose of this talk is demonstrate that crossed modules occur in very natural setting, namely if W^n is non-simply connected manifolds with a non-simply connected boundary V^{n-1}, then second Morse number $\mathcal{M}_2(W^n)$ of a manifold W^n can be calculated using crossed module $\pi_2(W^n, V^{n-1})$.

18:30-19:00 Debasis Sen (University of Haifa)
"Representing Bredon cohomology with local coefficients
by crossed complexes and parametrized spectra"

For a discrete group G, we represent the Bredon cohomology with local coefficients as the homotopy classes of maps in the category of equivaraint crossed complexes. Subsequently, we construct a naive parametrized G-spectrum, such that the cohomology theory defined by it reduces to the Bredon cohomology with local coefficients when restricted to suspension spectra of spaces.

TUESDAY, JULY 3, 2012 **Grand Hall U2, AGH U. Science & Technology:**

15:45-16:35 Sylvain Cappell (Courant Institute, New York University)
"Symmetries and Rigidity of Aspherical Manifolds:
A Counterexample to the Conner-Raymond Conjecture"

Classical work of Borel had shown that an action of the circle on a manifold with contractible universal cover yields non-trivial center in the manifold's fundamental group. In the 60's, Conner and Raymond made further deep investigations which led them to conjecture a converse to Borel's result. We construct counter-examples to this conjecture, i.e., we exhibit aspherical manifolds (in all dimensions greater than or equal to 6) which have non-trivial center in their fundamental groups but no circle actions. The constructions and invariants involve synthesizing disparate ideas of geometric topology of singular spaces, geometric group theory and hyperbolic geometry.
(This is joint work with Shmuel Weinberger and Min Yan.)

16:45-17:35 Norio Iwase (Kyushu University)
"On the equivariant systolic category"

To resolve the systolic freedom phenomena on a product of non-orientable manifolds, we introduce an equivariant version of a systolic category. In particular, we stabilize the mass on the twisted integral homology to eliminate the systolic freedom. For the stable mass, there is a stable isosystolic inequality induced from the cup-products as Gromov and Bangert-Katz showed. This implies that the systolic freedom from the product with a non-orientable manifold is actually eliminated by the stabilization process. As a corollary, it is

shown that the twisted real cup-length gives a lower bound of the twisted stable systolic category.

17:45-18:35 Clark Barwick (Massachusetts Institute of Technology)
"Waldhausen K-theory as a Goodwillie Derivative"

The Waldhausen K-theory of higher categories enjoys a universal property, analogous to the universal property of the Grothendieck group. One way of formulating this universal property is to describe it as a Goodwillie derivative of a familiar functor, viewed from a less familiar perspective.

WEDNESDAY, JULY 4, 2012 **Grand Hall U2, AGH U. Science & Technology:**

14:30-15:20 Simona Paoli (University of Leicester)
"n-fold groupoids, n-types and n-track categories"

Most homotopy invariants of topological spaces are filtered by dimension, so it is useful to have finite dimensional approximations to homotopy theories. We describe an algebraic model for the latter, which we call n-track categories. An appropriate algebraic model of n-types is developed for this purpose, with what we call *n-typical n-fold groupoids*. These lead to an explicit connection between n-types and iterated loop spaces and exhibit other useful properties. This is joint work with David Blanc.

15:30-16:00 Michal Kukiela (Nicholas Copernicus University, Torun)
"Non-compact discrete Morse theory and rayless spaces"

Discrete Morse theory, developed in the 90's by Robin Forman, is a convenient tool of combinatorial topology used to simplify the structure of finite CW complexes without altering their homotopy type. It has found applications in real world problems and in various areas of pure mathematics, including algebra, geometry and combinatorics.

In the talk I will present a generalisation of the theory to infinite complexes that is possible due to the resemblance of the properties of compact and rayless spaces (i.e. spaces that do not contain the half-open interval as a closed subspace). Further examples of similar situations and some remarks concerning this phenomenon will also be given.

16:10-16:40 Zbigniew Blaszczyk (Nicholas Copernicus University, Torun)
"Free actions of alternating groups on products of spheres"

Given a finite group G, write $k = k(G)$ for the minimal number such that G acts freely on a finite CW complex homotopy equivalent to $(S^n)^k$ for some $n > 0$. Such a number always exists: as observed by J. Tornehave, any finite group acts freely on a product of equidimensional spheres. A lot of effort has been put into determining k for various classes of groups. For example, the solution of the spherical space form problem asserts that $k(G) = 1$ if and only if G has periodic cohomology. We will discuss the behaviour of k for the alternating groups, a problem that tracks back to a 1979 paper of B. Oliver, where it is proven that $k(\mathcal{A}_4) > 2$. In particular, we will show that $k(\mathcal{A}_d) > d-2$ for any integer $d \geq 7$ and then improve this bound for certain values of d.