Algebraic homotopy and its applications: June 25-29, 2012.
Abstracts of the conferences

Greg Arone

TITLE: On the structure of derivatives and Taylor towers. (Joint work with M. Ching)

ABSTRACT: *Let F be a pointed homotopy functor. The Goodwillie derivatives of F form a symmetric sequence of spectra. By a theorem of Goodwillie, the derivatives of F determine the layers in the Taylor tower of F. We will investigate what further structure the derivatives of F possess, beyond that of a symmetric sequence, and how the entire Taylor tower (as opposed to just the layers) can be recovered from derivatives equipped with extra structures.*

Alexander Berglund

TITLE: Rational homotopy automorphisms of spaces via infinity-groupoids and Koszul duality.

ABSTRACT: *I will describe a new approach to the rational homotopy theory of mapping spaces which is inspired by Getzler's Lie theory for nilpotent L-infinity algebras. When combined with the characterization of formal and coformal spaces X in terms of Koszul duality, this approach yields small models for calculating the rational homotopy groups of the space $aut(X)$ of homotopy automorphisms. In joint work with Madsen, we use these models to determine the rational homotopy type of the classifying space $Baut(M)$ for highly connected manifolds M.*

Clemens Berger

TITLE: Goodwillie-calculus for Gamma-spaces (joint work in progress with Georg Biedermann, Osnabrück).

ABSTRACT: *In the early 70's, Gamma-spaces have been introduced by Segal as a combinatorial way of representing connective spectra. Later on, Bousfield and Friedlander equipped Gamma-spaces with two distinct Quillen model structures: a strict and a stable one; the first arises from considering Gamma-spaces as certain endofunctors of the category of based topological spaces, while the second derives from the first by localization with respect to stable equivalences. The purpose of this talk is to define, for each Gamma-space A, a tower of strict fibrations $P_{n+1}A \to P_nA$ such that the associated tower of endofunctors coincides with the Goodwillie tower of the endofunctor of A. In other words, we present a way of restricting "Goodwillie-calculus" to the category of Gamma-spaces. This recovers of course Segal's characterization of connective spectra as "very special" Gamma-spaces, but it also recovers results of Mauer-Oats stating roughly that, inside the category of Gamma-spaces, Goodwillie's n-excisive functors may be characterized by the vanishing of the $(n+1)$-st cross effects. We finally show how the calculation by Rognes and Johnson of the Goodwillie derivatives of the identity functor may be carried out (entirely combinatorially) inside the category of Gamma-spaces.*

Michael Ching

TITLE: Descent, operads and calculus

ABSTRACT: *I'll talk about two applications of homotopic descent: (i) to Koszul duality of operads (and their modules and algebras); and (ii) to Goodwillie calculus. These two applications are related and I'll try to explain how. This is based on joint work with John Harper, and separately with Greg Arone.*

Joana Cirici

TITLE: Homotopy Theory of Mixed Hodge Diagrams

ABSTRACT: *We study the homotopy theory of mixed Hodge diagrams of cdga's via the construction of cofibrant minimal models. Extending the Formality Theorem of compact Kähler varieties, we show that every complex algebraic variety (possibly open and singular)*

is filtered formal: the rational homotopy is determined by the first term of the spectral sequence associated with the weight filtration.

Octav Cornea

TITLE: Cobordism and the Fukaya category"

ABSTRACT:*After shortly explaining what the Fukaya category is, I will describe the existence of a functor relating it to a category of Lagrangian cobordisms. The existence and properties of this functor fits with a more general point of view that regards Lagrangian topology - which is a central part of symplectic topology - as the study of certain homotopy functors defined on cobordism categories. The talk is based on joint work with Paul Biran (ETH).*

Cristina Costoya

ABSTRACT: *Every finite group is the group of self homotopy equivalences of an elliptic space (joint with Antonio Viruel) In this paper we prove that every finite group G can be realized as the group of self-homotopy equivalences of infinitely many elliptic spaces X. Moreover, X can be chosen to be the rationalization of an inflexible compact simply connected manifold. http://arxiv.org/abs/1106.1087*

Aurélien Djament

TITLE: Homologie stable des automorphismes des groupes libres à coefficients tordus.

ABSTRACT: *Dans un travail en cours avec C. Vespa, nous montrons que la colimite sur l'entier n de l'homologie du groupe des automorphismes d'un groupe libre de rang n à coefficients tordus par un foncteur polynomial sans terme constant convenable est nulle. Nous utilisons pour cela des méthodes d'homologie des foncteurs qui ont déjà montré leur efficacité pour comprendre l'homologie des groupes linéaires ou orthogonaux à coefficients tordus par un foncteur polynomial. Comme application, on peut voir simplement qu'un sous-groupe "triangulaire" du groupe des automorphismes d'un groupe libre à n générateurs a stablement la même homologie que le groupe de tous les automorphismes. Le cas fondamental de notre résultat d'annulation est celui de l'homologie des automorphismes des groupes libres à coefficients dans l'abélianisation desdits groupes libres. Dans ce cas, le résultat apparaît - comme conséquence d'un théorème général de stabilité homologique - dans un article d'A. Hatcher et N. Wahl qui utilise des méthodes géométriques élaborées ; notre approche, purement algébrique, est beaucoup plus directe.*

Emmanuel Farjoun

TITLE: CH and quazi unital topological categories (after Harpaz)

ABSTRACT: *In order to give a complete detailed proof of the dim one cobordism hypothesis Harpaz following Lurie develops a good model for categories with only weakly defined units – quazi unital categories –of which the coborsim category is an example. This model is based based on Segal spaces due to Rezk localized at the appropriate equivalences. We give an overview of this construction and basic ideas of some proofs.*

Mattiaz Franz

TITLE: Equivariant cohomology, syzygies and orbit structure.

ABSTRACT: *The GKM method is a powerful way to compute the equivariant (and ordinary) cohomology of many spaces with torus actions. So far it has only been applied to so-called equivariantly formal T-spaces, for example to compact Hamiltonian T-manifolds. In this talk I will explain that the GKM method is valid for a much larger class of T-spaces. This result is based on a new interpretation of a sequence originally due to Atiyah and Bredon, and involves the notion of syzygies as used in commutative algebra. I will also present a surprising relation between the GKM description and the equivariant Poincaré pairing. (This is joint work with Chris Allday and Volker Puppe.)*

Soren Galatius

TITLE: Homology of moduli spaces of high dimensional manifolds

ABSTRACT: *For each n, there is a space M_g^n classifying smooth fiber bundles whose fibers are connected sums of g copies of $S^n \times S^n$. For $n = 1$, this is essentially Riemann's moduli space. I will discuss recent results with Randal-Williams about the homology of this space when g is large and $n > 2$.*

Tom Goodwillie

TITLE: On unstable pseudoisotopy

ABSTRACT: *An early application of functor calculus was to pseudoisotopy spaces, stabilized with respect to the dimension of the manifold. I will report on an attempt to apply the same methods to the homotopy fiber of the stabilization map.*

Steve Halperin

TITLE: 30 Years of Rational Homotopy Theory

ABSTRACT: *The foundational work of Quillen and Sullivan established an algebraic theory equivalent to the homotopy theory of rational spaces in which the homotopy class of a space was represented by an isomorphism class of a commutative graded differential algebra. In the subsequent decades this theory has been used to answer a sequence of difficult questions about the properties of rational spaces. During this entire period Yves Felix has been at the forefront of the research program, and this talk will review some of his principal achievements.*

Mike Hill

TITLE: What should we mean by a genuine equivariant commutative ring?

ABSTRACT: *I will describe a philosophy for equivariant symmetric monoidal structures, giving a new interpretation for what we really mean by an equivariant commutative ring. The model is informed by results in equivariant stable homotopy theory (both the rigid aspect of commutative ring spectra and the computational aspect of Mackey functors), and it underscores a need for equivariant algebra (a better notion of a G-ring) that captures more of the intuition.*

Kathryn Hess

TITLE: Duality, descent and extensions

ABSTRACT: *In recent work with Alexander Berglund, we studied the relationships among the notions of Koszul duality for dg algebras, Grothendieck descent for morphisms of dg algebras and Hopf-Galois extensions of dg algebras. We showed in particular if B is a multiplicative acyclic closure of a dg algebra A, and a dg Hopf algebra H coacts on B by algebra maps, then H is Koszul dual to A if and only if the inclusion map of A into B is an H-Hopf-Galois extension satisfying Grothendieck descent. In this talk I will briefly recall the notions of Koszul duality, homotopic Grothendieck descent and homotopic Hopf-Galois extension, then describe the common model-categorical framework into which all of these notions fit and sketch the proof of the result stated above. In particular I will explain the essential role of recent joint work with Brooke Shipley on model categories of coalgebras over comonads.*

Max Karoubi

TITLE: The homotopy fixed point theorem and the Quillen-Lichtenbaum conjecture in Hermitian K-theory (joint with A. J. Berrick, M. Schlichting, and P. A. Ostvaer)

ABSTRACT: *Let X be a noetherian scheme of finite Krull dimension, having 2 invertible in its ring of regular functions, an ample family of line bundles, and a global bound on the virtual mod-2 cohomological dimensions of its residue fields. We prove that the comparison map from the hermitian K-theory of X to the homotopy fixed points of K-theory under the natural $Z/2$-action is a 2-adic equivalence in general, and an integral equivalence when X has no formally real residue*

field. We also show that the comparison map between the higher Grothendieck-Witt (hermitian K-) theory of X and its étale version is an isomorphism on homotopy groups in the same range as for the Quillen-Lichtenbaum conjecture in K-theory. Applications compute higher Grothendieck-Witt groups of complex algebraic varieties and rings of 2-integers in number fields, and hence values of Dedekind zeta-functions.

Takuji Kashiwabara

TITLE: Morava K-theory and Brown-Peterson cohomology of infinite loop spaces associated to some bounded-below spectra.

ABSTRACT: *Classically well-known spectra were either (-1)-connected or periodic, with notable exceptions of spectra obtained by Brown-Comenetz duality. Of course, one could desuspend connected spectra to get spectra which are bounded below with non-trivial homotopy groups in negative degrees, but such gradings seemed artificial. However, in recent works surrounding the works of Madsen-Weiss theorem, certain Thom spectra with non-trivial homotopy groups in negative degrees play important roles. In this talk, we study the Morava K-theory and Brown-Peterson cohomology of infinite loop spaces associated with bounded below spectra of finite type whose ordinay homology is concentrated in even degrees.*

Jean-Louis Loday

Jean-Louis died at the age of 66 as a consequence of a sailing accident on June 6th. Here is the abstract he has sent us at the end of May.

TITLE: Higher operad theory

ABSTRACT: *Types of algebras are encoded by operads. Types of operads are encoded by some sort of higher operads. We introduce higher operad theory and show its relationship with families of polytopes on the one hand and canonical basis of quantum groups on the other hand.*

MAX KAROUBI will give a short talk in memory of Jean-Louis Loday.

Luc Menichi

TITLE: Eilenberg-Moore spectral sequence and string topology.

ABSTRACT: *Let M be a simply-connected closed manifold. Chas and Sullivan have defined a product on the shifted homology of the free loop space $\mathbb{H}(LM)$. Consider over any field , the usual homological Eilenberg- Moore spectral sequence converging to $\mathbb{H}(LM)$. Using results of Félix and Thomas, we show that this spectral sequence is multiplicative with respect to the Chas-Sullivan loop product and that its E_2-term is the Hochschild cohomology of $H(M)$. This gives a new method to compute the loop homology algebra of spheres and complex projective spaces. This is joint work with K. Kuribayashi and T. Naito.*

Sergei Merkulov

TITLE: A line in the plane and the Grothendieck-Teichmueller group

ABSTRACT: *The Grothendieck-Teichmueller group (GT) appears in many different parts of mathematics: in the theory of moduli spaces of algebraic curves, in number theory, in the theory of motives, in the theory of deformation quantization etc. Using recent breakthrough theorems by Thomas Willwacher, we argue that GT controls the deformation theory of a line in the complex plane when one understands these geometric structures via their associated operads of (compactified) configuration spaces. Applications of this result to Poisson geometry and Batalin-Vilkovisky formalism are discussed.*

Joan Milles

TITLE: Complex structures as homotopy algebras.

ABSTRACT: *A complex structure is an almost complex structure which is integrable. A local description of such a structure reveals a lot of algebraic equations. Sergei Merkulov has studied*

the Nijenhuis integrability condition and he has proposed a simple interpretation of the equations characterizing Nijenhuis structures in terms of homotopy algebras. Following this attempt to define "homotopy geometry", we make use of the curved Koszul duality to describe complex structures as homotopy algebras.

George Raptis

TITLE: Cobordism categories and the A-theory characteristic

ABSTRACT: The A-theory characteristic, defined by Dwyer, Weiss and Williams, is a parametrised Euler characteristic, for fibrations with homotopy finite (or finitely dominated) fibers, and it takes values in Waldhausen's A-theory. Regarding the classifying space of the cobordism category, defined by Galatius, Madsen,Tillmann and Weiss, as a "stable" moduli space of smooth manifolds, it is natural to ask whether it is a possible to extend the A-theory characteristic to the cobordism category. A candidate such extension was defined recently by Boekstedt and Madsen. In this talk, I will discuss the connection of this map with the A-theory characteristic and the universal topological Riemann-Roch theorem in the sense of Dwyer, Weiss and Williams.

Yuli Rudiak

TITLE: Topological complexity and configuration spaces (joint with I. Basabe, J. Gonzalez and D. Tamaki)

(The following is a cut of the summary in arXiv:1009.1851)

ABSTRACT: *... Farber's notion of topological complexity is extended by defining, for $n \geq 2$, the n^{th} topological complexity $TC_n(X)$ of a path-connected space X. In this talk we develop further the properties of this extended concept, relating it to the Lusternik-Schnirelmann category of cartesian powers of X, as well as to the cup-length of the diagonal embedding $X \hookrightarrow X^n$. We compute the numerical values of TC_n for products of spheres, closed 1-connected symplectic manifolds (e.g. complex projective spaces), and quaternionic projective spaces. We explore the symmetrized version of the concept ($TC_n^S(X)$) and introduce a new symmetrization ($STC_n(X)$) which is a homotopy invariant of X. ....*

Jerome Scherer

TITLE: Nilpotent groups up to homotopy and homotopy nilpotent groups

ABSTRACT: *This is joint work with Boris Chorny. Nilpotent groups can be described as algebras over a Lawvere theory. In the homotopy category, this description leads to the notion of nilpotent groups "up to homotopy", which has a very close link with Samelson products. Biedermann and Dwyer constructed a new algebraic theory based on Goodwillie calculus to define homotopy nilpotent groups. We show that iterated Samelson products vanish in such objects, because they do so in F(X) for any n-excisive functor F from pointed spaces to pointed spaces and any finite space X. Comparison with other forms of nilpotency in homotopy theory shows this is the best way to approach this concept.*

Lionel Schwartz

TITLE: On N. Kuhn's conjectures

ABSTRACT: *One will first discuss non realization theorems for unstable modules as the cohomology of spaces. These questions were raised by N. Kuhn and E. Kochmann. Then, the talk will focuss on the properties on indecomposable elements of the cohomology, in connection with the preceding results and with results of Félix, Halperin, Lemaire and Thomas on one side, Crespo, Castellana and Schere on the other side.*

Stefan Schwede

TITLE: Equivariant properties of symmetric products

ABSTRACT: *The filtration on the infinite symmetric product of spheres by number of factors provides a sequence of spectra between the sphere spectrum and the integral Eilenberg-Mac Lane spectrum. This filtration and the subquotients are interesting stable homotopy types. I will discuss the equivariant stable homotopy types, for finite groups, obtained by filtering the infinite symmetric product of representation spheres. Already on the zeroth homotopy groups an interesting filtration of the augmentation ideal of the Burnside ring functor arises. Our method is by 'global' homotopy theory, i.e., we study the simultaneous behaviour for all finite groups at once.*

Don Stanley

TITLE: Rational Homotopy Invariance of Configuration Spaces

ABSTRACT: *I discuss the problem of whether the configuration space of n points on a closed manifold M, $F(M,n)$ is a homotopy invariant of the manifold. Salvatore and Longoni showed that even though the lens spaces $L_{7,1}$ and $L_{7,2}$ are homotopy equivalent, their configuration spaces of 2 points are not homotopy equivalent. On the other hand for 2-connected manifold, $F(M,2)$ is a homotopy invariant. Working over the rationals Fulton-MacPherson and Kriz constructed a model for $F(M,k)$ when M is a complex projective variety. In particular this implies that the rational homotopy type of these configuration spaces is homotopy invariant. I will present recent work with Pascal Lambrechts that constructs a similar model for $F(M,3)$ for any closed manifold M that is 4-connected. The method seems to generalize to n points.*

Christine Vespa

TITLE: Polynomial functors from groups to abelian groups

ABSTRACT: *Although many areas of algebra study only additive functors between abelian categories, many functors are obviously non additive. For example, if we consider the category of abelian groups Ab, we can define a functor $n : Ab \to Ab$ which associates to an abelian group G the n-th tensor product $n(G) = G^{\otimes n}$ This functor is not additive but is a polynomial functor of degree n. In general, combinatorial description of polynomial functors is a very intricate problem. In 2001 Baues, Dreckmann, Franjou and Pirashvili give a description of polynomial functors from abelian groups to abelian groups in terms of non-linear Mackey functors. The aim of this talk is to present a generalization of this result for polynomial functors from groups to abelian groups (obtained in collaboration with Hartl and Pirashvili). This description is a consequence of the two following results. First we obtain a description of polynomial functors from P-algebras (for P a set-operad) to abelian groups. Secondly we obtain an isomorphism between polynomial functors on monoids and those on groups.*

Michael Weiss

TITLE: Smooth maps to the plane and Pontryagin classes

ABSTRACT: *Rational characteristic classes for fiber bundles where the fiber is a euclidean space of dimension n are not very well understood. The following is still a hypothesis or conjecture: the rational Pontryagin classes of Novikov and Thom satisfy all the relations that they satisfy for vector bundles of dimension n. Smoothing theory leads to a reformulation of this hypothesis which is about spaces of smooth regular maps to the plane. I shall describe an approach to this which introduces spaces of smooth maps to the plane with only mild singularities, in the tradition of concordance theory (e.g. J. Cerf).*