

Topology

Ecuador 2017



AUGUST 14-18, 2017

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- Ryszard Nest, University of Copenhagen
- Angélica Osorno, Reed College
- Ulrike Tillmann, University of Oxford

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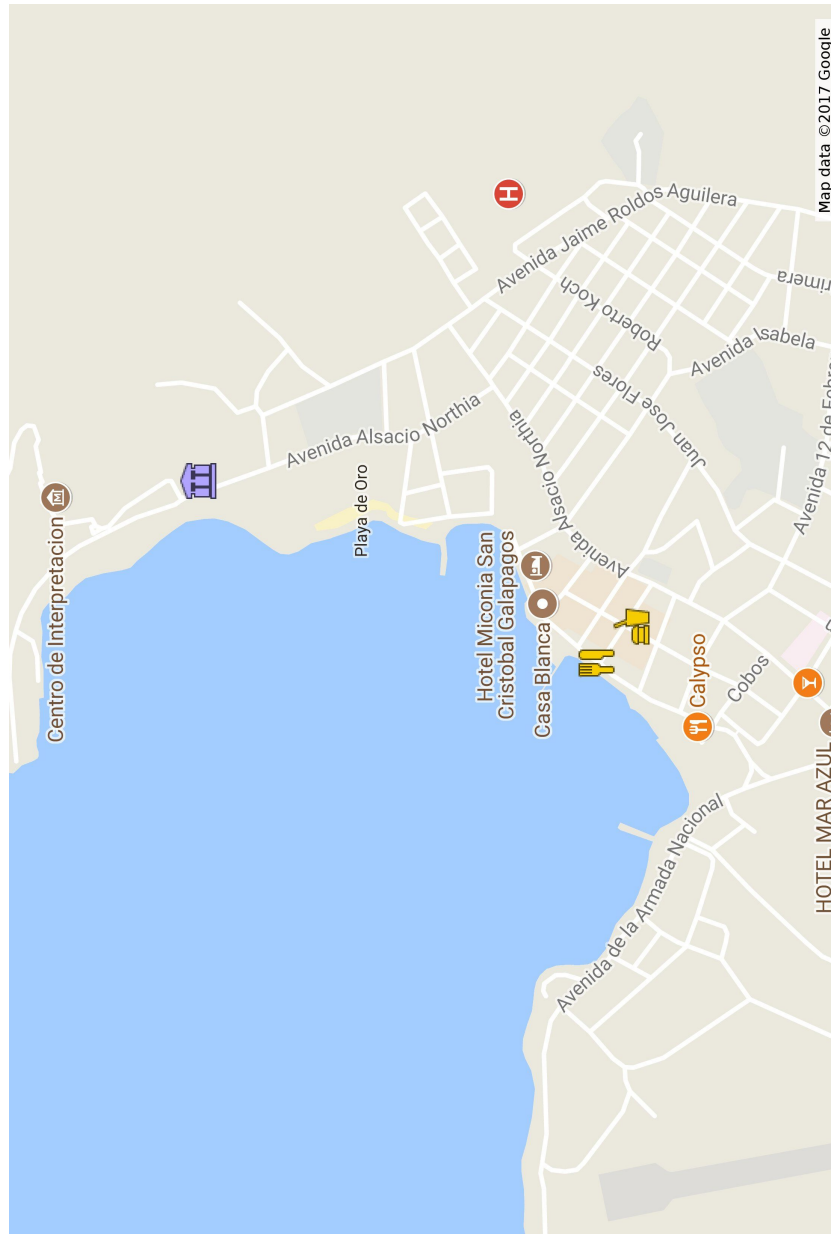
1. LOCATION

The conference will take place in the Galapagos Academic Institute for the Arts & Sciences (GAIAS), which is the campus of Universidad San Francisco de Quito (USFQ) in the island of San Cristobal in Galapagos. You can find the location of GAIAS in the map below or on its online version [here](#).

Topology Ecuador 2017

Basic locations

-  Universidad San Francisco de Quito (GAIAS)
-  Airport Isla San Cristobal
-  Restaurant area
-  Lunch places "Almuerzos"



2. SCHEDULE

2.1. Overview.

Monday		Tuesday	Thursday		Friday	
Welcome and infos		Peter May				
Moira Chas		Diversity in maths	Dennis Sullivan		Kathryn Hess	
Soren Galatius		John Greenlees	Sara Azzali		Bob Bruner	
Lunch						
Ben Knudsen	Paul Arnaud Songhafouo Tsopméné	Claudia Scheimbauer	Kate Poirier	Cesar del Corral	Ralph Kaufmann	Tomer Schlank
Lauren Bandklayder	Kevin Piterman	José Manuel Gómez	Kathryn Lesh	Jacek Brodzki	Jovana Obradovic	Christian Wimmer
Manuel Rivera	Fabian Hebestreit	Reception	Jérôme Scherer	Ernesto Lupercio		

Wednesday is an excursion day. Most participants will take part in pre-arranged excursions.

2.2. Detailed Schedule.

	Monday	
08:30 - 09:15	<i>Registration</i>	
09:15 - 09:30	<i>Welcome and infos</i>	
09:30 - 10:30	Moira Chas (5) <i>Computer driven questions, pre-theorems and theorems in geometry</i>	
10:30 - 11:00	<i>Coffee break</i>	
11:00 - 12:00	Soren Galatius (7) <i>Homological stability and meta-stability for mapping class groups of surfaces</i>	
14:00 - 14:45	Ben Knudsen (13) <i>Subdivisional spaces and graph braid groups</i>	Paul Arnaud Songhafouo Tsopméné (24) <i>Generalization of Manifold Calculus</i>
15:00 - 15:45	Lauren Bandklayder (2) <i>A proof of the Dold-Thom theorem using factorization homology</i>	Kevin Piterman (18) <i>The homotopy types of the posets of p-subgroups</i>
15:45 - 16:15	<i>Coffee break</i>	
16:15 - 17:00	Manuel Rivera (20) <i>Cubical rigidification, cobar construction, based loop space</i>	Fabian Hebestreit (10) <i>A vanishing theorem for tautological classes of aspherical manifolds</i>

	Tuesday
09:00 - 10:00	Peter May (16) <i>Glimpses of equivariant algebraic topology</i>
10:00 - 10:30	Coffee break
10:30 - 11:00	<i>Diversity in mathematics</i>
11:00 - 12:00	John Greenlees (9) <i>The structure of rational equivariant cohomology theories</i>
14:00 - 15:00	Claudia Scheimbauer (21) <i>Fully extended functorial field theories and dualizability in the higher Morita category</i>
15:00 - 15:30	Coffee break
15:30 - 16:30	José Manuel Gómez (8) <i>Commutative K-theory</i>
	Reception

	Thursday	
09:00 - 10:00	Dennis Sullivan (25) <i>Combinatorial Hydrodynamics</i>	
10:00 - 10:30	Coffee break	
10:30 - 11:30	Sara Azzali (1) <i>Flat bundles, \mathbb{R}/\mathbb{Z}-K-theory and rho invariants</i>	
14:00 - 14:45	Kate Poirier (19) <i>Moduli spaces of graphs for string topology</i>	Cesar del Corral (6) <i>Noncommutative Residue and Canonical Trace on a Manifold with Boundary</i>
15:00 - 15:45	Kathryn Lesh (14) <i>A classification of p-toral subgroups with noncontractible fixed point sets on decomposition space</i>	Jacek Brodzki (3) <i>A differential complex for $CAT(0)$ cubical spaces</i>
15:45 - 16:15	Coffee break	
16:15 - 17:00	Jérôme Scherer (22) <i>Relative resolutions for unbounded chain complexes</i>	Ernesto Lupercio (15) <i>Quantum Toric Varieties</i>

	Friday	
09:00 - 10:00	Kathryn Hess (11) <i>Topology meets neuroscience</i>	
10:00 - 10:30	Coffee break	
10:30 - 11:30	Bob Bruner (4) <i>A(2)-Modules and their Cohomology</i>	
14:00 - 14:45	Ralph Kaufmann (12) <i>Moduli Spaces and Feynman categories</i>	Tomer Schlank (23) <i>Ultra-Products and Chromatic Homotopy Theory</i>
15:00 - 15:45	Jovana Obradovic (17) <i>Categorified cyclic operads</i>	Christian Wimmer (26) <i>Rational global homotopy theory</i>
15:45 - 16:15	Coffee break	

3. ABSTRACTS

- (1) Sara Azzali, *Universität Potsdam*
Flat bundles, \mathbb{R}/\mathbb{Z} -K-theory and rho invariants

Atiyah, Patodi and Singer constructed the relative K-theory class $[\alpha]$ associated with a flat unitary vector bundle over a closed manifold. This class is related to the spectral invariant rho of a Dirac operator by the so called index theorem for flat bundles, which computes the pairing between $[\alpha]$ and the K-homology class $[D]$ of the Dirac operator. In this talk, after introducing the context and the needed tools, we show that $[\alpha]$ admits a canonical construction, using von Neumann algebras and that, as a secondary class, it results from Atiyah's L^2 -index theorem for covering. Taking an operator algebraic point of view, we show that Atiyah's property can be encoded using KK-theory with real coefficients (which will be introduced). This permits to generalise the constructions of secondary classes of type rho in the noncommutative setting of a discrete group Γ suitably acting on a C^* -algebra A .

Based on joint work with Paolo Antonini and Georges Skandalis.

- (2) Lauren Bandklayder, *Northwestern University*
A proof of the Dold-Thom theorem using factorization homology

The Dold-Thom theorem is a classical result in algebraic topology relating homotopy and homology. It states that for a nice, based topological space M , there is an isomorphism between the homotopy groups of the symmetric product of M and the homology groups of M itself: $\pi_*(Sym(M; A)) \cong H_*(M; A)$. The crux of most known proofs of this is to check a certain map is a quasi-fibration. This is a bit of a technical digression, and it my goal present a more direct proof which does not require any such fact.

- (3) Jacek Brodzki, *University of Southampton*
A differential complex for CAT(0) cubical spaces

In the 1980's Pierre Julg and Alain Valette, and also Tadeusz Pytlik and Ryszard Szwarc, constructed and studied a certain Fredholm operator associated to a simplicial tree. The operator can be defined in at least two ways: from a combinatorial flow on the tree, similar to the flows in Forman's discrete Morse theory, or from the theory of unitary operator-valued cocycles. These constructions and ideas have foundational applications to the theory of completely bounded representations of groups that act on trees, and to the Selberg principle in the representation theory of p -adic groups.

This talk will present an extension of the constructions of Julg and Valette, and Pytlik and Szwarc, to CAT(0) cubical spaces. The construction is quite intricate and relies in a crucial way on the rich and beautiful geometry of these spaces. To illustrate the utility of the extended construction we will sketch an application of these ideas to operator K-theory where we give a new proof of K-amenability for groups that act properly on bounded-geometry CAT(0)-cubical spaces. This is joint work with Nigel Higson and Erik Guentner.

(4) Bob Bruner, *Wayne State University and University of Oslo*
A(2)-Modules and their Cohomology

Modules over subalgebras of the Steenrod algebra (such as $A(2)$) exhibit periodicities and localizations which illuminate their module structure and simplify the calculation of their cohomology. This has topological correlates. For example, just as

- $A(2)$ -modules are related to topological modular forms,
- $A(1)$ -modules are related to real K-theory, and
- $A(0)$ -modules to integral cohomology.

We will discuss these and related theories and the manner in which these periodicities appear as the complexity of the subalgebra increases.

(5) Moira Chas, *Stony Brook University*
Computer driven questions, pre-theorems and theorems in geometry

Several numbers can be associated to free homotopy class X of closed curves on a surface S with boundary and negative Euler characteristic. Among these,

- the self-intersection number of X
- the word length of X
- the length of the geodesic corresponding to X
- the number of free homotopy classes of a given word length the mapping class group orbit of X .

The interrelations of these numbers exhibit many patterns when explicitly determined or approximated by running a variety of algorithms in a computer.

We will discuss how these computations lead to counterexamples to existing conjectures and to the discovery of new patterns. Some of these new patterns, so intricate and unlikely that they are certainly true (even if not proven yet), are “pre-theorems”. Many of these pre-theorems later became theorems. An example of such a theorem states that the distribution of the self-intersection of free homotopy classes of closed curves on a surface, appropriately normalized, sampling among given word length, approaches a Gaussian when the word length goes to infinity. An example of a counterexample (no pun intended!) is that there exists pairs of length equivalent free homotopy classes of curves on a surface S that have different self-intersection number. (Two free homotopy classes X and Y are length equivalent if for every hyperbolic metric M on S , $M(X) = M(Y)$).

This talk will be accessible to grad and advanced undergrad students.

(6) Cesar del Corral, *Universidad de los Andes*
Noncommutative Residue and Canonical Trace on a Manifold with Boundary

This talk addresses the existence (and uniqueness) of the noncommutative residue and canonical trace on pseudo-differential operators on manifolds with boundary.

On the one hand, the noncommutative residue was introduced in 1984 by Wodzicki M. and independently by Guillemin V., the authors shown that the noncommutative residue is the unique trace on the class of classical pseudo-differential operators on a closed manifold, i.e. the unique linear functional which vanishes on commutators of operators. This functional was popularized by A. Connes in the context of the noncommutative geometry because of its many application in such field, as in many others. On the other hand, the canonical trace on closed manifolds was studied and popularized by Kontsevich, M. and Vishik, S. 1995, and shown to be the unique trace on appropriate classes of

classical pseudo-differential operators which extends the usual trace for trace class operators.

Fedosov, B.V., Golse, F., Leichtnam, E. and Schrohe, E. provided an extension of the noncommutative residue on an algebra of boundary value operators for a manifold with boundary, called the Boutet de Monvel algebra. Such algebra exclude the class of operators where the canonical trace is defined, namely, operators of non-integer order. Drawn by the necessity to circumvent the transmission property we provide a class classical pseudo-differential operator on a manifold with boundary (which contains the Boutet de Monvel algebra) and extends the canonical trace to this class. Finally, we discuss as the traciality property as the uniqueness of the noncommutative residue and the canonical trace in the case of a manifold with boundary, and we give some possible new applications to noncommutative geometry and C^* -algebras following the approaches from Connes A., Scott S., Schrohe, E. and many others authors.

- (7) Soren Galatius, *Stanford University and University of Copenhagen*
Homological stability and meta-stability for mapping class groups of surfaces

Let $\Gamma_{g,1}$ denote the mapping class group of a genus g surface with one parametrized boundary component. The group homology $H_i(\Gamma_{g,1})$ is independent of g , as long as g is large compared to i , by a famous theorem of Harer known as homological stability, now known to hold when $2g > 3i$. Outside that range, the relative homology groups $H_i(\Gamma_{g,1}, \Gamma_{g-1,1})$ contain interesting information about the failure of homological stability. In this talk, I will discuss a “metastability” result, obtained in joint work with Oscar Randal-Williams and Alexander Kupers: these relative homology groups depend only on the number $k = 2g - 3i$, as long as g is large compared to k .

- (8) José Manuel Gómez, *Universidad Nacional de Colombia, sede Medellín*
Commutative K-theory

In this talk I will introduce a new generalized cohomology theory called Commutative K-theory. This theory is defined transitionally commutative vector bundles. I will start the talk by introducing the space of commuting elements in a Lie group G and discuss a few simple examples. Then I will show how those spaces can be assembled together obtain a space that is called the classifying space for commutativity in G and how these spaces classify precisely transitionally commutative vector bundles. After that I will introduce commutative K-theory and discuss some general properties. I will also discuss the recent computation of the homotopy groups of this theory made by Simon Gritschacher.

This is a joint work with Alejandro Adem, John Lind and Ulrike Tillmann.

- (9) John Greenlees, *University of Sheffield*
The structure of rational equivariant cohomology theories

If one wants to understand modules over a field one can classify them, but in general the way to understand categories of modules is to think of them as sheaves over the prime spectrum. The same thing applies to rational equivariant cohomology theories for a compact Lie group G . For finite groups one may classify them, but in general one should think of them as sheaves over the Balmer spectrum. The talk will describe the Balmer spectrum (its points correspond to closed subgroups of G) and the Zariski topology on it. In principle the talk could

continue to describe the nature of the algebraic model this engenders, but in practice there is unlikely to be time for this.

The key ingredients are the Borel-Hsiang-Quillen localization theorem (identifying the rational cohomology of fixed points under a torus for a finite G -space), tom Dieck's identification of the Burnside ring and the algebraic model of free cohomology theories due to the speaker and Shipley.

- (10) Fabian Hebestreit, *Universität Bonn*

A vanishing theorem for tautological classes of aspherical manifolds

Joint with M. Land, W. Lück and O. Randal-Williams

Tautological or generalised Morita-Miller-Mumford classes have recently been of great interest due to the work of Galatius and Randal-Williams who used them to describe the cohomology of classifying spaces of diffeomorphism groups of many high dimensional, high-genus manifolds in a range. In contrast, the diffeomorphism groups of high dimensional aspherical manifolds have long been studied successfully using surgery and Waldhausen's A -theory. However, since the genus of an aspherical manifold vanishes previous work reveals little about their tautological classes. In the talk I will explain a recent result of ours which shows that on almost all aspherical manifolds almost all tautological classes almost vanish. Two of these almos are enforced by hyperbolisation and the Madsen-Weiss theorem, respectively, whereas the third is an artefact of our methods, which rely on both the Farrell-Jones conjecture and a less known conjecture of Burghelea in group cohomology.

- (11) Kathryn Hess, *Ecole polytechnique fédérale de Lausanne*

Topology meets neuroscience

I will present an overview of applications of topology to neuroscience on a wide range of scales, from the level of neurons to the level of brain regions. In particular I will describe collaborations in progress with the Blue Brain Project on topological analysis of the structure and function of digitally reconstructed microconnectomes and on topological classification of neuron morphological types. I will then briefly sketch applications of topology to the analysis of brain imaging data.

- (12) Ralph Kaufmann, *Purdue University*

Moduli Spaces and Feynman categories

Feynman categories provide a unifying categorical framework for several aspects appearing in algebraic topology, non-commutative geometry and moduli spaces. There is a combinatorial level which describes such things as operads and modular operads as functors from a category whose morphisms have a graph theoretical presentation. Through resolutions and W -constructions, this combinatorial level is elevated to a dg-setting or to a topological setting. Finally, non-(co)commutative bi and Hopf algebras naturally appear in this context as well and provide a link to motivic constructions. We will shortly give the axiomatic setup and then focus on the construction of moduli spaces using the W -construction and decorations. If time permits, we will also briefly discuss the Hopf algebras and possible implications including multiple zeta values and Grothendieck-Teichmüller theory.

- (13) Ben Knudsen, *Harvard University*
Subdivisional spaces and graph braid groups

We develop an approach to the study of the configuration spaces of a cell complex X that is both flexible and suitable for computation. We proceed by viewing X , together with its subdivisions, as a “subdivisional space,” a kind of diagram object, which has associated to it certain diagrammatic versions of configuration spaces. These objects, which model the correct homotopy types, mix the discrete and the continuous, and they may be attacked by combining techniques drawn from discrete Morse theory and factorization homology. We apply our theory in the 1-dimensional example of a graph, obtaining a new family of chain models for the homology of graph braid groups depending only on intrinsic graph theoretic data. These “intrinsic complexes” come equipped with a robust computational toolkit, which we exploit in numerous calculations, old and new. This is joint work with Byung Hee An and Gabriel Drummond-Cole.

- (14) Kathryn Lesh, *Union College*
A classification of p -toral subgroups with noncontractible fixed point sets on decomposition space

Recent joint work with G. Arone combines with joint work with J. Bergner, R. Joachimi, V. Stojanoska, and K. Wickelgren to give a complete classification of p -toral subgroups of $U(n)$ that have noncontractible fixed points on the poset of decompositions of complex n -space into proper orthogonal subspaces.

- (15) Ernesto Lupercio, *Cinvestav IPN Mexico*
Quantum Toric Varieties

In this talk I will explain our generalization of toric varieties to the non-commutative geometric realm. The resulting quantum toric varieties are built up out of quantum tori and classical toric varieties are an example. Unlike the classical counterpart, quantum toric varieties have moduli.

- (16) Peter May, *University of Chicago*
Glimpses of equivariant algebraic topology

From P.A. Smith to the present. Around 80 years ago, Smith proved the remarkable result that if a finite p -group G acts on a compact space X having the mod p homology of a sphere, then the fixed point space X^G also has the mod p homology of a sphere. Equivariant algebraic topology has developed in fits and starts ever since. I'll give some glimpses of current directions and questions.

- (17) Jovana Obradovic, *Université Paris Diderot and Inria, France*
Categorified cyclic operads

The goal of this work is to establish the notion of categorified cyclic operad. This is done by weakening the axioms of cyclic operads, from equalities to natural isomorphisms, and by formulating conditions concerning these isomorphisms which ensure coherence. For entries-only cyclic operads, this coherence is of the same kind as the coherence of symmetric monoidal categories: all diagrams

made of associator and commutator isomorphisms are required to commute. However, in the setting of cyclic operads, where the existence of objects and morphisms depends on the shape of a fixed unrooted tree, these arrows do not always exist. In other words, the coherences that Mac Lane established for symmetric monoidal categories do not solve the coherence problem of categorified cyclic operads. We exhibit the appropriate conditions of this setting and prove the coherence theorem, relying on a result of Dosen and Petric coming from the coherence of categorified operads. Additionally, by the equivalence between the two possible characterisations of cyclic operads, for cyclic operads introduced as operads with extra structure (that exchanges the output of an operation with one of its inputs), i.e. for exchangeable-output cyclic operads, we examine which of the axioms of the extra structure needs to be weakened (in order to lift that equivalence to weakened structures), and we exhibit the appropriate coherence conditions.

- (18) Kevin Piterman, *Universidad de Buenos Aires*

The homotopy types of the posets of p -subgroups

The posets $Sp(G)$ and $Ap(G)$ of non-trivial p -subgroups and elementary abelian p -subgroups of a finite group G were introduced by K. Brown and D. Quillen in the 70's to study the connections between their topological properties and the algebraic properties of the group. A very well-known conjecture of Quillen states that the simplicial complex associated to $Sp(G)$ is contractible if and only if G has a non-trivial normal p -subgroup. Quillen's conjecture is still open in general, but there have been considerable advances in this direction in the last four decades, especially by the work of Aschbacher and Smith. In the 80's R.E. Stong investigated the posets $Sp(G)$ and $Ap(G)$ from the point of view of the theory of finite topological spaces, and a few years ago J. Barmak reformulated Quillen's conjecture using simple homotopy theory of finite spaces. In this talk I will recall some of the most relevant results on these posets and exhibit new results that we obtained recently in collaboration with Gabriel Minian. In particular I will describe the contractibility of the finite space $Ap(G)$ in terms of the algebraic properties of G .

- (19) Kate Poirier, *City University of New York - New York City College of Technology*

Moduli spaces of graphs for string topology

String topology studies natural operations on the loop space of a manifold arising from intersections of loops. One wishes to have an understanding of a universal space parametrizing all such operations. Moduli spaces of Riemann surfaces—and their compactifications—are known to be helpful in this parameterization, usually via combinatorial models using graphs which capture intersection information. Different treatments of string topology offer different spaces of graphs which have different relationships with moduli space and with one another. Egas and Kupers provide one attempt at synthesizing the relationship among these spaces of graphs by comparing certain combinatorial models of moduli space that have been used for string topology. In this talk, we provide another chapter of this synthesis by describing the relationship between the spaces of graphs parametrizing the chain-level string topology operations of Drummond-Cole, Poirier, and Rounds and the spaces of graphs parameterizing the algebraic string operations of Tradler and Zeinalian. We also describe how they fit into the Egas-Kupers and moduli space pictures.

- (20) Manuel Rivera, *University of Miami - CINVESTAV*
Cubical rigidification, cobar construction, based loop space

I will explain how to generalize Adams' cobar construction to possibly non-simply connected spaces. The methods used, which are of independent interest, consist on a cubical interpretation of the Lurie rigidification functor originally defined to compare two models of infinity-categories.

- (21) Claudia Scheimbauer, *Oxford University*
Fully extended functorial field theories and dualizability in the higher Morita category

Atiyah and Segal's axiomatic approach to topological and conformal quantum field theories provided a beautiful link between the geometry of "spacetimes" (cobordisms) and algebraic structures. Combining this with the physical notion of "locality" led to the introduction of the language of higher categories into the topic. Natural targets for extended topological field theories are higher Morita categories: generalizations of the bicategory of algebras, bimodules, and homomorphisms.

After giving an introduction to topological field theories, I will explain how one can use geometric arguments to obtain results on dualizability in a "factorization version" of the Morita category and using this, examples of low-dimensional field theories "relative" to their observables. An example will be given by polynomial differential operators, i.e. the Weyl algebra, in positive characteristic and its center. This is joint work with Owen Gwilliam.

- (22) Jérôme Scherer, *Ecole polytechnique fédérale de Lausanne*
Relative resolutions for unbounded chain complexes

This is joint work with W. Chacholski, A. Neeman, and W. Pitsch. Sometimes it is difficult (or maybe even unknown) to construct a model structure in a specific homotopical situation. This is so for the category of unbounded chain complexes over a commutative ring where the weak equivalences should reflect some relative properties (by changing the class of injective modules say). This is when a model approximation comes in handy because it provides more flexibility than a model structure. I will explain what a model approximation is and show that Spaltenstein's idea of truncating a complex, resolving the pieces, and taking the limit, provides such a model approximation, at least when the category of chain complexes satisfies a relative version of Roos' axiom AB4*-n. This axiom is satisfied in many interesting examples, but fails sometimes, as should be expected ...

- (23) Tomer Schlank, *Hebrew University In Jerusalem*
Ultra-Products and Chromatic Homotopy Theory

Let $C_{p,n}$ be the $E(n)$ -local category at height n and prime p . These categories are of great interest to the stable homotopy theorist since they serve as the "bounded pieces" of the chromatic filtration on the category of spectra. It is a well known observation that for a given height n certain "special" phenomena happen only for small enough primes. Further, in some sense, the categories $C_{p,n}$ become more regular and algebraic as p goes to infinity for a fixed n . The goal of this talk is to make this intuition precise.

In a 96' unpublished paper Jens Franke defined for every height n and a prime p the category $Fr_{n,p}$ of Quasi-periodic complexes on the stack $MFG(p)^{\leq n}$ as an algebraic analog of $C_{p,n}$. Now given an infinite sequence of mathematical structures, logicians have a method to construct a limiting one by using ultra-products. We shall define a notion of ultra-product of categories and then for a fixed height n we prove:

$$\prod_p^{\text{Ultra}} C_{n,p} \cong \prod_p^{\text{Ultra}} Fr_{n,p}.$$

This is a joint project with N. Stapleton and T. Barthel.

- (24) Paul Arnaud Songhafouo Tsopméné, *University of Regina, Canada*
Generalization of Manifold Calculus

Let M be a smooth manifold, and let $O(M)$ be the poset of open subsets of M . Manifold calculus, due to Goodwillie and Weiss, is a calculus of functors suitable for studying contravariant functors $F : O(M) \rightarrow \text{Top}$ from $O(M)$ to the category of spaces (of which the embedding functor $\text{Emb}(-, W)$ for a fixed manifold W is a prime example). Weiss showed that polynomial functors of degree $\leq k$ are determined by their values on $O_k(M)$, where $O_k(M)$ is the full subposet of $O(M)$ whose objects are open subsets diffeomorphic to the disjoint union of at most k balls. Afterwards Pryor showed that one can replace $O_k(M)$ by more general subposets and still recover the same notion of polynomial functor. In this talk, we will first explain the philosophy of Manifold Calculus. Next we will give some examples and applications. Lastly, we will show that the aforementioned results can be generalized to functors from $O(M)$ to any (simplicial) model category. This is a joint work with Donald Stanley.

- (25) Dennis Sullivan, *Stony Brook University - CUNY Graduate Center*
Combinatorial Hydrodynamics

The motion of real fluids can only approximate the motion described by the PDEs that model fluid mechanics. For example the beautiful Euler PDE for incompressible zero viscosity [no friction] fluid evolution says the twisting or turning in 3D of the motion [the vorticity] is continually transported forward by the motion. In topology one approximates the spatial continuum by a cell complex. Using the ideas that are needed to construct the induced transformation in combinatorial topology we construct a cellular or combinatorial model of "the vorticity is transported by the motion". We will report on some studies of this model and how they relate to physical incompressible fluid motion.

- (26) Christian Wimmer, *University of Bonn*
Rational equivariant commutative ring spectra

Stable homotopy theory simplifies drastically if one consider spectra up to rational equivalence. It is well-known that taking homotopy groups induces an equivalence

$$G\text{-SHC} \simeq_{\mathbb{Q}} \text{gr.} \prod_{(H \leq G)} \mathbb{Q}[WH]\text{-mod}$$

between the genuine G -equivariant stable homotopy category (G finite) and the category of graded modules over the Weyl groups WH indexed by the conjugacy classes of subgroups of G . However, this approach is too primitive to be useful

for the comparison of highly structured ring spectra in this setting. I will explain how geometric fixed points equipped with additional norm maps related to the Hill-Hopkins-Ravenel norms can be used to give an algebraic model. They induce an equivalence

$$\mathrm{Com}(G\text{-}\mathrm{Sp})_{\mathbb{Q}} \simeq \mathrm{Orb}_G\text{-}\mathrm{CDGA}_{\mathbb{Q}}$$

between the homotopy theory of rational commutative G -ring spectra and Orb_G -diagrams in rational commutative differential graded algebras, where Orb_G is the orbit category of the group G . I will also try to indicate the analogous global equivariant statements.

4. LIST OF PARTICIPANTS

Aaron Abrams	Washington and Lee University
Alexander Schmitt	Freie Universität Berlin
Andrea Moreira	Universidad San Francisco de Quito
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Ismar Volic	Wellesley College
J. Peter May	University of Chicago
Jacek Brodzki	University of Southampton
Jeffrey Carlson	University of Toronto
Jens Jakob Kjaer	University of Notre Dame
Jerome Scherer	EPFL
John Greenlees	University of Sheffield
John Skukalek	Universidad San Francisco de Quito
Jonathan Ortiz	Escuela Politécnica Nacional
Jonathan Weitsman	Northeastern University
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Lauren Bandklayder	Northwestern University
Malgorzata Kaczmarek	University of Southampton

Manuel Rivera	University of Miami - CINVESTAV
Marc Stephan	University of British Columbia
Moirá Chas	Stony Brook University
Paul Arnaud SONGHAFOUO TSOPMENE	University of Regina, Canada
Pierre-Louis Curien	CNRS and University Paris 7
Ralph Kaufmann	Purdue University
Robert Bruner	Wayne State University and University of Oslo
Roberto Torres	
Robin Koytcheff	University of Louisiana-Lafayette
Sara Azzali	Universität Potsdam
Soren Galatius	Stanford and Copenhagen
Teresa Matos	Universidad San Francisco de Quito
Terrence Bisson	Canisius College
Thomas Williams	University of British Columbia
Tomás Mejía	Universidad Nacional de Colombia
Tomer Schlank	Hebrew University In Jerusalem
Vladimir Verchinine	Université de Montpellier
Yongbin Ruan	University of Michigan
Yuli Rudyak	University of Florida

5. TRANSPORT

5.1. From the airport. The easiest way from the airport to the hotel is to take a taxi. Most taxis in Galapagos are white pick-up vans. The cost of a taxi from the airport to the town is around US \$ 1.50 - 2 per person.

5.2. Within the town. The town of San Cristobal is small enough to reach anything by foot. However, if one wishes one can take a taxi for US \$ 1.50 - 2 per person per ride anywhere within the town. If one would like to visit other spots on the island which are outside the town, then it is also recommended to travel by taxi.

6. IMPORTANT TRAVEL INFORMATION

The following information has been provided by the travel agency Neotropic Expeditions.

- **Luggage:** The weight restriction per person for the flight to Galapagos Islands is 20 kg - 23 kg (depending on the airline). It is only allowed to bring one piece of checked luggage.
- **Season:** Year-round
- **Altitude:** 0 – 1,124 meters (3,688 feet) above sea level
- **Weather:** During the cool season from June to December, air temperature is around 21 to 24 C (70 to 75 F) at sea level. Temperature decreases with altitude.
- **Water temperature:** During the cool season from June to December, average water temperature is about 22 C (72 F). Water temperature also varies significantly by location.
- **Local Currency:** US dollar
- **Electricity:** in Ecuador the standard electrical voltage is 110V
- **Galapagos entrance fee:** This fee was established with the objective of recovering the investment costs required to carry out conservation and management activities. *The Galapagos entrance fee can only be paid in cash on spot.* The cost for the entrance fee is: *US \$100 per person.*
- **The Ingala Galapagos Transit Control Card (TCC):** The Galapagos Transit Control Card (TCC) is an immigration control measure set by INGALA, the Ecuadorian Governmental agency that regulates all things pertaining to the Galapagos Islands. The TCC intends to control migration to the Galapagos by keeping track of who is entering and leaving the Islands, and the duration of everyone's stay. It is mandatory to present the card at arrival and departure.

The cost for the TCC is fixed at \$20 per person, for both nationals and foreigners. It can be purchased at the airports of Quito or Guayaquil, look for the INGALA booth at the domestic flight terminals. A flight reservation and a valid ID are required.

For passengers who do not prepay the TCC prior to arrival, we recommend that they arrive to the airport at least 2 hours in advance of their Galapagos flight in order to avoid any delays.

- **SICGAL:** All passengers travelling to the Galapagos must check their luggage at the SICGAL point before airline check in. The Galapagos Inspection and Quarantine System (SICGAL), is a program of the Ecuadorian Service for Agricultural Health (SESA) and features a high degree of interinstitutional coordination aimed at preventing new species and organisms from being introduced into the Galapagos Islands.

7. FOOD

The food areas can be found in the map in section 1, or on its online version [here](#).

- **Restaurants:** There are many restaurants on the shore line between the streets “Cobos” and “Hernan Melville”.
- **Lunch:** Further away from the shoreline along the streets “Ignacio Hernandez” or “Avenida Alsacio Northia”, between the streets “Cobos” and “Hernan Melville” you can find more affordable options for lunch. You should ask for an “almuerzo” which consists of a set lunch menu.
- **Reception on Tuesday:** On Tuesday after the afternoon session there will be a reception at GAIAS.

8. SUPPORTED BY

- **Universidad San Francisco de Quito**
- **Berlin Mathematical School**
- **International Mathematical Union**
- **AMARUN**
- **Wiley** “Journal of Topology, published by Wiley on behalf of the London Mathematical Society, publishes papers of high quality and significance in topology, geometry and adjacent areas of mathematics. The Editors welcome submissions on exciting new advances concerning interesting, important and often unexpected links connecting topology and geometry with many other parts of mathematics, as well as those in the core subject areas of the journal”

9. EMERGENCY CONTACT

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