

# Manifolds, $K$ -Theory, and Related Topics

## Dubrovnik, Croatia, June 23–27, 2014

### Titles and abstracts

These are the titles and abstracts for all the conference talks, plenary and contributed. The speakers are listed alphabetically.

#### David Ayala (Montana State)

Title: *On the Taylor tower of factorization homology*

Abstract: Factorization homology is a 'coordinate free' pairing of an  $n$ -manifold and an  $n$ -Disk algebra – it specializes to topological Hochschild homology for the case of a circle. I will explicate the Goodwillie cofiltration of factorization homology in terms of configuration spaces, and argue that it converges on an understood class of algebras. From this we can deduce a general formulation of Poincaré duality as it intertwines with Koszul duality. This duality accommodates some easy calculations, after which we can make some open observations about a duality among TQFT's that exchanges perturbative and non-perturbative. This is joint work with John Francis.

#### David Barnes (Queen's University)

Title: *Rationalising the orthogonal calculus*

Abstract: Orthogonal calculus is a calculus of functors, inspired by Goodwillie calculus. It takes as input a functor from finite dimensional inner product spaces to topological spaces and as output gives a tower of approximations by well-behaved functors. The output captures a lot of important homotopical information and is an important tool for calculations. This talk will describe current work on setting up model structures for a rational version of Weiss' orthogonal calculus.

#### Irina Bobkova (Northwestern)

Title: *Towards a resolution of the  $K(2)$ -local sphere at the prime 2*

Abstract: The homotopy of the  $p$ -local sphere spectrum  $S$  is determined by a family of localizations  $L_{K(n)}S$  with respect to Morava  $K$ -theories  $K(n)$ . We will discuss some computations when  $p, n = 2$ . Considerable information here can be derived from the action of the Morava stabilizer group on the Lubin-Tate theory. Goerss, Henn, Mahowald and Rezk have constructed a resolution of the  $K(2)$ -local sphere at the prime 3 which allows to simplify computations of  $\pi_*L_{K(2)}S$ . We will discuss a generalization of their work to the prime 2 and construct a resolution of the spectrum  $E^{hS^1_2}$ , which is closely related to the  $K(2)$ -local sphere at the prime 2.

#### Gunnar Carlsson (Stanford)

Title: *On the topology of finite metric spaces*

Abstract: Finite metric spaces are an excellent way to model problems coming from the analysis of large and complex data sets. Over the last 15 years, there has been a development of cohomological methods for dealing with them. I will survey the results and future directions for this work.

#### Wojciech Chacholski (KTH)

Title: *Idempotent symmetries of spaces*

Abstract: This is a joint work with E. Dror Farjoun, R. Flores, and J. Scherer.

Let  $G$  be a group. Define  $BG$  to be the collection of these connected spaces  $X$  for which  $\pi_1 X = G$  and the map  $\pi_1: \text{Map}_*(X, X) \rightarrow \text{Hom}(G, G)$  is a weak equivalence. The Eilenberg-Mac Lane space  $K(G, 1)$  clearly belongs to  $BG$ . The question is if there are other spaces in  $BG$ . Flores and Scherer showed that  $B\Sigma_3$  contains a space whose universal cover is the homotopy fiber of the degree 3 map on the sphere  $S^3$ . During the talk I will present evidence for the following conjecture:

*If  $G$  is a finite group, then  $BG$  contains only finitely many different homotopy types.*

This conjecture is a reflection of certain symmetries of the category of pointed spaces. An augmented functor of spaces  $c_X: \phi(X) \rightarrow X$  is called idempotent if  $\text{Map}_*(\phi(X), c_X): \text{Map}_*(\phi(X), \phi(X)) \rightarrow \text{Map}_*(\phi(X), X)$  is a weak equivalence for any  $X$ . The  $A$ -cellularization  $c_{A,X}: CW_A X \rightarrow X$  is a typical example. The conjecture is equivalent to the orbit under the idempotent functors of the Eilenberg-Mac Lane space  $K(G, 1)$  being finite for a finite  $G$ . For evidence for the conjecture one might look at orbits of idempotent deformations in other categories. For example it is a theorem that in the category of groups, a finite group has only finitely many idempotent deformations. Furthermore the orbit of a finite simple group can have at most 7 elements. In the talk I will explain why the conjecture is true if  $G$  is nilpotent and present some of its consequences. One of the steps to prove that case is a generalization of the Blakers–Massey theorem.

### Stanley Chang (Wellesley)

Title: *The virtual structure set*

Abstract: This talk will introduce the notion of a structure set in the context of the surgery exact sequence. We will show that the Borel conjecture for compact manifolds cannot be extended into the proper noncompact setting by exhibiting examples of arithmetic manifolds whose proper structure set is nontrivial. At the end we will also introduce the notion of a virtual structure set defined on an infinite sequence of covers, and explain some interesting calculations regarding these objects.

### Michael Ching (Amherst)

Title: *Manifolds, K-theory and the calculus of functors*

Abstract: I will explain joint work with Greg Arone that describes the structure on the derivatives needed to reconstruct the Goodwillie tower of a homotopy functor from based spaces to spectra. For some functors, this structure has a nice form: the derivatives form a module over the Koszul dual of the stable little  $n$ -discs operad. We can characterize the functors for which this is the case as those that are left Kan extensions from a certain category of "pointed framed  $n$ -dimensional manifolds" and "pointed framed embeddings". I will also try to describe joint work with Greg Arone and Andrew Blumberg to figure out where Waldhausen's algebraic  $K$ -theory of spaces fits into this picture.

### Boris Chorny (Haifa)

Title: *A classification of small linear functors*

Abstract: We extend Goodwillie's classification of finitary linear functors to arbitrary small functors. (A functor is small if it commutes with  $\lambda$ -filtered colimits for some cardinal  $\lambda$ .) Namely we show that every small linear simplicial functor from spectra to simplicial sets is weakly equivalent to a filtered colimit of representable functors represented in cofibrant spectra. Moreover, we present this classification as a Quillen equivalence of the category of small functors from spectra to simplicial sets equipped with the linear model structure and the opposite of the pro-category of spectra with the strict model structure.

### Ralph Cohen (Stanford)

Title: *Comparing Topological Field Theories: the string topology of a manifold and the symplectic cohomology of its cotangent bundle*

Abstract: I will describe joint work with Sheel Ganatra, in which we prove an equivalence between two chain complex valued topological field theories: the String Topology of a manifold  $M$ , and the Symplectic Cohomology of its cotangent bundle,  $T^*M$ . I will also discuss how the notion of Koszul duality appears in the study of TFT's.

### Emanuele Dotto (MIT)

Title: *Homotopy theory of equivariant diagrams and equivariant calculus of functors*

Abstract: In recent joint work with Kristian Moi we develop a homotopy theory of equivariant diagrams. Given a finite group  $G$  acting on a category  $I$ , we consider  $I$ -shaped diagrams in a model category  $C$  (typically spaces or spectra) that are equipped with a " $G$ -action that permutes the vertices of the diagram". When  $I = P(J)$  is the poset of subsets of a finite  $G$ -set  $J$ , we call these diagrams equivariant cubes. The Bousfield-Kan formula provides homotopy (co)limit functors from the category of equivariant diagrams in  $C$  to the category of  $G$ -objects in  $C$ . For equivariant cubes this leads to a notion of homotopy (co)cartesian  $G$ -cubes. A functor is  $G$ -excisive if it sends cocartesian  $G$ -cubes to cartesian  $G$ -cubes. I will relate this notion of equivariant excision to equivariant cohomology theories and to previous work on  $G$ -linearity of Blumberg. If time allows, I will talk about higher  $G$ -excision and how to set up an equivariant Goodwillie Taylor tower, and discuss convergence for functors that satisfy an equivariant Blakers-Massey theorem.

### Bjørn Dundas (Bergen)

Title: *Higher topological Hochschild homology*

Abstract: In the 1980's Goodwillie conjectured the existence of a Hochschild-style theory agreeing with stable  $K$ -theory. This proved to be a very fruitful point of view; refinements and generalizations have both provided calculations of important invariants and access to new ones. Most importantly, it has given us an inroad to questions about algebraic  $K$ -theory through stable equivariant homotopy theory. In this talk I will discuss some very recent calculations j/w Lindenstrauss and Richter of higher topological Hochschild homology.

### Rosona Eldred (Münster)

Title: *Goodwillie calculus and nilpotence*

Abstract: Viewing spectra as the homotopy-abelianization of spaces, the Goodwillie Taylor tower of a homotopy functor is a sort of homotopy-nilpotent tower. Work of Biedermann-Dwyer shows that (loops on)  $n$ -excisive functors land in spaces which are homotopy-nilpotent in a related sense. I will discuss a strengthening of this result by establishing a stronger property on the finite limits used to construct the polynomial approximations. Time permitting, I will also describe the dual setting, which involves spaces with bounded cup product length, and related conjectures of further structure.

### Tom Goodwillie (Brown)

Title: *Scissors congruence in mixed dimensions*

Abstract: We define a graded ring  $E$  in which  $E_n$  is a Grothendieck group for compact polytopes of dimension at most  $n$  in Euclidean spaces. (The cokernel of the evident map  $E_{n-1} \rightarrow E_n$  is the  $n$ th Euclidean scissors congruence group.) Ring maps  $E \rightarrow R$  are called multiplicative invariants with values in the ring  $R$ ; the first examples are the volume  $E \rightarrow \mathbb{R}$  and the Euler characteristic  $\chi : E \rightarrow \mathbb{Z}$ . We consider also an analogous object  $L$ , which is based not on polytopes but on germs of polytopes at a point. The ring  $L$  has more structure than  $E$ ; in particular it is a kind of Hopf algebroid. This means that there is a partial multiplication of local multiplicative invariants  $L \rightarrow R$ . (Its definition generalizes that of the Dehn invariant.) In fact,  $\text{Spec } L$  can be viewed as the morphism space of a groupoid scheme over  $\mathbb{Z}$  whose object space is the affine line. The local invariants act on the global invariants. Starting with obvious invariants related to volume and Euler characteristic, one can then create a family of invariants with values in polynomial rings over tensor powers of the real numbers.

### Jesper Grodal (Copenhagen)

Title: *The gluing conjecture*

Abstract: I will discuss progress on the gluing conjecture in block theory, including a verification for finite groups of Lie type. This involves looking at finite groups of Lie type through the eyes of homotopy theory.

### Ian Hambleton (McMaster)

Title: *Finite group actions and chain complexes over the orbit category*

Abstract: The unit spheres in orthogonal representations of finite groups give examples of group actions on spheres. We investigate non-linear actions by studying chain complexes over the orbit category, and constructing finite  $G$ -CW complexes. This leads to new examples of homotopy representations with isotropy of rank one. This project is joint with Ergun Yalcin (Bilkent University, Ankara).

### Kathryn Hess (Lausanne)

Title: *Waldhausen  $K$ -theory via comodules*

Abstract: I will present joint work with Brooke Shipley, in which we have defined a model category structure on the category of  $\Sigma^\infty X_+$ -comodule spectra such that the  $K$ -theory of the associated Waldhausen category of homotopically finite objects is naturally weakly equivalent to the usual Waldhausen  $K$ -theory of  $X$ ,  $A(X)$ , when  $X$  is simply connected. I will sketch a number of application of this new approach to the  $K$ -theory of spaces and describe its relation to the more familiar description in terms of  $\Sigma^\infty \Omega X_+$ -module spectra.

### Sadok Kallel (American University Sharjah)

Title: *On the topology of diagonal arrangements and their complements*

Abstract: Given a finite simplicial complex  $X$ , a diagonal arrangement in  $X^n$  is the union of various "diagonal subspaces" in this product. The complement of these arrangements give a generalization of the standard configuration space construction. In this talk we discuss the homology and homotopy groups through a range of these diagonal arrangements, their stable splittings and Euler characteristics. The answers are given in terms of invariants of  $X$ .

### John Klein (Wayne State)

Title: *Topological Stochastics*

Abstract: This talk is about statistical field theories arising from observables which are homological in nature. Starting with a finite CW complex of finite dimension  $d$ , I will show how to construct a stochastic process in which the state space is given by integer-valued cellular  $(d-1)$ -cycles. A trajectory is given by a sequence of states equipped with waiting times, in which successive states are by joined by instantaneous jumps over  $d$ -cells.

I will then construct a family of current observables and show how it gives rise to a real homology class in degree  $d$  called, "average current."

Lastly, I'll discuss a fractional quantization result, which roughly says that if certain parameters driving the system (driving time, inverse temperature) tend to infinity, then the average current converges to a rational homology class.

### Ben Knudsen (Northwestern)

Title: *Configuration spaces and factorization homology*

Abstract: I will describe recent work using factorization homology to compute the Betti numbers of the configuration spaces of  $k$  unordered points in an arbitrary manifold, possibly with boundary, generalizing theorems of Bodigheimer-Cohen-Taylor and Felix-Thomas.

### Robin Koytcheff (Victoria)

Title: *Homotopy Bott-Taubes integrals and the Milnor triple linking number*

Abstract: Bott and Taubes produced knot invariants by considering a bundle over the space of knots and integrating differential forms along its fiber. Their methods were used to construct all Vassiliev (or finite-type) knot invariants, as well as Vassiliev-type classes, which are real cohomology classes in spaces of knots in Euclidean space of dimension at least 4. By replacing integration of forms by a Pontrjagin-Thom construction, we can produce cohomology classes with arbitrary coefficients. We have so far recovered the Milnor triple linking number for string links via this method. Along the way, we find a description of this invariant as the degree of a certain map. More generally, we should be able to produce integral multiples of all the Vassiliev-type classes, showing that these classes are rational.

### Nick Kuhn (Virginia)

Title: *The Whitehead conjecture and the Goodwillie tower of the circle*

Abstract: The Goodwillie tower of the identity, when specialized to odd dimensional spheres, has many wonderful properties. In particular, localized at a prime  $p$ , one gets a spectral sequence converging to the homotopy groups of the  $2n + 1$  sphere which start from the stable homotopy groups of certain spaces  $L(k, n)$ . When  $n = 0$ , it has been long conjectured that the spectral sequence collapses at  $E^2$ . This amounts to saying that certain non-infinite loop maps from  $QL(k, 0)$  to  $QL(k + 1, 0)$  assemble to give a long exact sequence in homotopy. Meanwhile, infinite loop maps in the other direction appear in the statement of a conjecture of G. Whitehead from the late 1960's. By calculating everything on primitives in mod  $p$  homology, I have shown that these two sets of maps fit together in the best way possible. This proves the conjecture about the Goodwillie tower at all primes (Behrens has a version when  $p = 2$ ), and simplifies and unifies my 1982 and 1985 proofs of the Whitehead Conjecture. The Hecke algebras of type  $A$  may make an appearance.

### Alexander Kupers (Stanford)

Title: *A local-to-global principle for homological stability*

Abstract: Out of a framed  $E_n$ -algebra  $A$  and a  $n$ -manifold  $M$  one can construct the topological chiral homology of  $M$  with coefficients in  $A$ . We prove a local-to-global principle for topological chiral homology in the sense that for open  $M$  the topological chiral homology of  $M$  with coefficients in  $A$  has homological stability if and only if  $A$  itself has. This uses a characterization as homological stability as some time of "bounded generation".

### Anssi Lahtinen (KTH)

Title: *String topology of classifying spaces*

Abstract: Analogous to string topology of manifolds, string topology of classifying spaces studies the rich algebraic structure admitted by the homology groups of free loop spaces of classifying spaces of compact Lie groups. In this talk, I will discuss my recent joint work with Richard Hepworth where we extend the previously available structure in string topology of classifying spaces into an entirely new kind of field theory which includes operations parameterized by homology groups of automorphism groups of free groups with boundaries in addition to operations parameterized by homology groups of mapping class groups of surfaces. This work shows that the algebraic structures in string topology of classifying spaces can be brought into line with, and in fact far exceed, those available in string topology of manifolds.  
Preprint: <http://arxiv.org/abs/1308.6169>

### Kathryn Lesh (Union)

Title:

Abstract:

### Ib Madsen (Copenhagen)

Title: *Automorphisms of manifolds and rational homotopy theory*

Abstract: The lecture will discuss the homotopical and homological structure of the classifying spaces of homotopy automorphism groups and block diffeomorphism groups of 'generalized surfaces' of dimension  $2d$ . This uses rational homotopy theory. The description of homotopy groups is in terms of the derivation Lie algebra of certain free Lie algebras. The group of components of the automorphism groups under consideration are arithmetic groups. They act on the Lie algebra cohomology and the Borel vanishing theorem is used to enumerate the cohomology of the classifying spaces we study.

### Cary Malkiewich (Stanford)

Title: *Coassembly in algebraic K-theory*

Abstract: The coassembly map allows us to approximate any contravariant homotopy-invariant functor by an excisive functor, i.e. one that behaves like a cohomology theory. We apply this construction to a contravariant form of Waldhausen's algebraic  $K$ -theory of spaces, and its attendant  $THH$  functor. The results are somewhat surprising: the most obvious dual form of the Novikov conjecture is false, but when the space in question is the classifying space  $BG$  of a finite  $p$ -group, coassembly on  $THH$  is actually split surjective after  $p$ -completion.

**Randy McCarthy (Illinois)**

Title: *Unbased Calculus*

Abstract: Though Tom Goodwillie's original definition for Calculus of functors is not from a base pointed category, much of the current results in the subject are in the base pointed setting. In this talk we will give some results about the unbased calculus and some motivation why this is an interesting setting for some natural questions.

**Jeremy Miller (CUNY Graduate Center)**

Title: *Homological stability for symmetric complements*

Abstract: I will discuss a proof of a conjecture of Vakil and Wood concerning homological stability for certain subspaces of symmetric products. This conjecture is motivated by similar stability results in the Grothendieck ring of varieties. The proof gives further evidence that a notion of motivic stability considered by Vakil and Wood is strongly correlated with classical homological stability. This is joint work with Alexander Kupers and TriThang Tran.

**Justin Noel (Regensburg)**

Title: *On a nilpotence conjecture of J.P. May*

Abstract: In 1986 Peter May made the following conjecture:

Suppose that  $R$  is a ring spectrum with power operations (e.g., an  $E_\infty$  ring spectrum/ commutative  $S$ -algebra). Then the elements in the kernel of the integral Hurewicz homomorphism  $\pi_* R \rightarrow H_*(R; \mathbb{Z})$  are nilpotent.

The proof is short, simple and only uses results that have been around since the late 90's. As corollaries we obtain nilpotence results in various cobordism rings including  $\Omega_*^{Spin}$  and  $\Omega_*^{String}$ , results about the behavior of the Adams spectral sequence for  $E_\infty$ -ring spectra, the non-existence of  $E_\infty$ -ring structures on certain complex oriented ring spectra, and an analogue of Quillen's  $\mathcal{F}$ -isomorphism theorem for Lubin–Tate theories.

This project is joint with Akhil Mathew and Niko Naumann.

**Daniel Pryor (Louvain-la-Neuve)**

Title: *Cosimplicial models of embedding spaces and exponential growth of their homology*

Abstract: In this talk I will explain how Goodwillie-Weiss manifold calculus can be used to study spaces of smooth embeddings. In particular we prove that if  $M$  is a compact manifold with Euler characteristic less than  $-1$ , then the Betti numbers of the space of embeddings of  $M$  into  $\mathbb{R}^d$  grow exponentially. We also show that, given a model of  $M$  as a simplicial finite set, we can build a cosimplicial space whose totalization is the space of embeddings of  $M$  into another manifold  $W$ , generalizing to any manifold the cosimplicial model of Sinha for the space of long knots.

**George Raptis (Regensburg)**

Title: *K-theory of derivators*

Abstract: In this talk I will give a concise survey of derivator  $K$ -theory and discuss the comparison with Waldhausen  $K$ -theory.

**Charles Rezk (Illinois)**

Title: *Linearization and the Bousfield-Kuhn functor*

Abstract:

**Marcy Robertson (Western Ontario)**

Title: *Higher Prop(erad)s*

Abstract: For a nice symmetric monoidal model category  $V$ , there is a model structure on  $V$ -enriched (colored) properads. Under additional assumptions on  $V$ , which hold, for example, when  $V$  is simplicial sets or chain complexes over  $\mathbb{Q}$ , this model structure is proper. The properness of the model structure is used as a tool to prove a base-change theorem generalizing work of Muro. All of our results have analogues for operads and dioperads. If time permits we will show that there is a homotopy coherent nerve functor from the category of simplicially-enriched properads to the category of graphical sets, and elements in the image satisfy a weak inner Kan condition. This is joint work with Philip Hackney and Donald Yau.

**Paolo Salvatore (Rome)**

Title: *Configuration spaces models*

Abstract:

**Jerome Scherer (EPFL)**

Title: *Cellular Blakers-Massey*

Abstract: This is joint work with W. Chacholski. The Blakers-Massey Theorem tells us what the difference is between the initial object of a homotopy push-out diagram and the homotopy pull-back. Goodwillie's way of stating this is to say how connected the total fiber of the square is. We propose a version where we say how one can construct this total fiber from the original data, recovering in particular the connectivity statement. We also hope to provide cubical analogues. This cellular version is a key ingredient in our recent work with Farjoun and Flores about cellular properties of nilpotent spaces.

### Christian Schlichtkrull (Bergen)

Title: *Graded Thom spectra and logarithmic topological Hochschild homology*

Abstract: We give a survey of the logarithmic topological Hochschild homology introduced by the speaker in joint work with J. Rognes and S. Sagave, and we explain how the notion of a graded Thom spectrum naturally enters in this context.

### Dev Sinha (Oregon)

Title: *The Goodwillie-Weiss tower for knots is finite type*

Abstract: We explain how the Goodwillie-Weiss tower for classical knots yields finite type invariants. Volić established this for the abelianized/homology tower. For classical knots themselves, a main issue is establishing a group structure on components of spaces in the tower compatible with connect sum, which is a component-level version of recent work of Turchin and Arone-Lesh. Further work on the homotopy spectral sequence, and calculations of Conant and Turchin, give strong evidence that the Goodwillie-Weiss tower is a universal finite-type invariant ("over the integers"). This is joint work with Budney, Conant and Koytcheff.

### Paul Arnaud Songhafou Tsopméné (Louvain-la-Neuve)

Title: *The rational homology of spaces of long links*

Abstract: We provide a complete understanding of the rational homology of the space of long links. First, we construct explicitly a cosimplicial chain complex  $L_*^\bullet$  whose totalization is quasi-isomorphic to the singular chain complex of the space of long links. Next we show (using the fact that the Bousfield-Kan spectral sequence associated to  $L_*^\bullet$  collapses at the  $E^2$  page) that the homology Bousfield-Kan spectral sequence associated to the Munson-Volić cosimplicial model for the space of long links collapses at the  $E^2$  page rationally, and this solves a conjecture of Munson-Volić. Our method is mainly based on the "compactly supported" version of Goodwillie-Weiss embeddings calculus, and enables us also to obtain the collapsing at the  $E^2$  page of the spectral sequence computing the rational homology of the high dimensional analogues of spaces of long links.

### Wolfgang Steimle (Bonn)

Title: *On the map of Bökstedt-Madsen from the cobordism category to  $A$ -theory*

Abstract: Bökstedt and Madsen defined an infinite loop map from the embedded  $d$ -dimensional cobordism category of Galatius, Madsen, Tillmann and Weiss to the algebraic  $K$ -theory of  $BO(d)$  in the sense of Waldhausen. The purpose of the talk is to present two results in relation to this map. The first result is that it extends the universal parametrized  $A$ -theory Euler characteristic of smooth bundles with compact  $d$ -dimensional fibers, as defined by Dwyer, Weiss and Williams. The second result is that it actually factors through the stable homotopy of  $BO(d)$  through Waldhausen's unit map. This is joint work with G. Raptis.

### Markus Szymik (Copenhagen)

Title: *Derived natural transformations of the identity functor and the free loop space*

Abstract: The center of a category captures the universal operations on its objects. In this talk, I will first explain how to adapt this concept to contexts with an associated homotopy theory, leading to a calculus of derived natural transformations of the identity functor. This gives a non-linear version of Hochschild cohomology that is related to the free loop space. I will then explain how to calculate this in almost all cases of interest, based on joint work with W.G. Dwyer.

### Hiro Lee Tanaka (Harvard)

Title: *Quillen's  $s$ -dot construction and Bridgeland Stability Conditions*

Abstract: Given a stable  $\infty$ -category (or a triangulated category), together with some additional data, one can construct a moduli space of Bridgeland stability conditions, which is famously a complex manifold. This complex manifold defines a factorization algebra on the real line, and this factorization algebra organizes the data of Hall algebras and wall-crossing.

### Ulrike Tillmann (Oxford)

Title: *Commutative  $K$ -Theory and other new generalised cohomology theories*

Abstract: Vector bundles over a compact manifold can be defined via transition functions to a linear group. Often one imposes conditions on this structure group. For example for real vector bundles one may ask that all transition functions lie in the special orthogonal group to encode orientability. Commutative  $K$ -theory arises when we impose the condition that the transition functions commute with each other whenever they are simultaneously defined. We will introduce commutative  $K$ -theory and some natural variants of it, and will show that they give rise to new generalised cohomology theories. This is joint work with Adem, Gomez and Lind building on previous work by Adem, F. Cohen, and Gomez.

### Victor Turchin (Kansas State)

Title: *Rational homotopy of long embeddings as the homology of the outer space*

Abstract: It turns out that the rational homotopy of the spaces of long embeddings  $\mathbb{R}^m \rightarrow \mathbb{R}^n$ ,  $n > 2m + 1$ , can be described as the locally finite homology of the outer space with coefficients in a non-trivial local system. The answer is different depending on whether the codimension is even and odd. One of the secondary consequences of our computations is that the inclusion of the little discs operad  $B_m \rightarrow B_{m+1}$  is never formal. (Joint work with T. Willwacher.)

### Mark Ullmann (Berlin)

Title: *New coefficients for the Farrell-Jones conjecture*

Abstract: The Farrell-Jones Conjecture for algebraic  $K$ -Theory, a group  $G$  and a ring  $R$  gives a description of  $K_n(R[G])$  in terms of  $K_m(R[V])$ ,  $m \leq n$ , where  $V$  runs over the virtually cyclic subgroups of  $G$ , and the geometry of  $G$ . It is known for a huge class of groups.

I will explain a program to obtain similar results when  $R$  is a simplicial ring (or, maybe, a connective ring spectrum).

### Deborah Vicinsky (Oregon)

Title: *Derivatives of the identity functor and operads*

Abstract: It has been conjectured that the derivatives of the identity functor always have the structure of an operad. I will discuss my efforts to find examples of categories in which this occurs. I will construct the suspension functor in the category of small categories with the canonical model structure. Then I will describe the stabilization of this category and what this implies about the derivatives of the identity functor.

### Michael Völkl (Regensburg)

Title: *Differential cohomology theories as sheaves of spectra*

Abstract: We show that every (infinity-categorical) sheaf on manifolds with values in spectra yields a differential extension of a generalized cohomology theory. In particular we construct the Simons-Sullivan differential cohomology diagram and prove the homotopy formula. In the end, we discuss some examples.

This is joint work (<http://arxiv.org/abs/1311.3188>) with U. Bunke and T. Nikolaus.

### Nathalie Wahl (Copenhagen)

Title:

Abstract:

### Shmuel Weinberger (Chicago)

Title: *Equivariant surgery – because the  $h$ -principle doesn't work*

Abstract: Surgery theory, classically, is a situation where the  $h$ -principle fails = structure sets are locally linear functors - they differ from a homology theory by a locally constant functor (one that only depends on the fundamental group). The situation for equivariant surgery is much more interesting.

### Michael Weiss (Münster)

Title: *Manifold calculus, operads, configuration categories and smooth embeddings with exotic derivatives*

Abstract: Joint work with Boavida. The main point is an operadic description of the homotopy theoretic obstructions to deforming smooth immersions into smooth embeddings. Applications to spaces of high-dimensional long knots, closely related to recent work of Arone-Turchin and Dwyer-Hess on the same theme.

### Abdoulkader Yacouba Barma (Louvain-la-Neuve)

Title: *Cocyclic structure and space of knots*

Abstract: The space of knots is naturally equipped with a  $S^1$ -space structure. The space of long knots has a cosimplicial model. The  $S^1$ -space structure appears on the totalization of  $Z^\bullet$  when  $Z^\bullet$  is a cocyclic space. It is natural to hope a cocyclic model for space of knots. In our talk we will build a cocyclic space  $Z^\bullet$  and show that its totalization is the space of knots. To conclude we will give a brief summary of further work to be done.

### Sarah Yeakel (Illinois)

Title: *Classifying  $n$ -excisive functors by generic representations*

Abstract: Kuhn classified degree  $n$  functors of vector spaces by modules over matrix rings, which he calls generic representations. This result was generalized by McCarthy for endofunctors of module spectra, and we will discuss a further generalization of Kuhn's result to  $n$ -excisive functors from nice simplicial model categories to spaces or spectra. Motivated by Bökstedt's construction for  $THH$ , we use a slight modification to Goodwillie's construction of the  $n$ -th Taylor polynomial that admits the extra structure needed to obtain the result.

### **Inna Zakharevich (IAS)**

Title: *A spectral sequence for the Grothendieck spectrum of varieties*

Abstract: Algebraic  $K$ -theory provides a generalization of the Grothendieck group to an entire spectrum of invariants. The classical examples in which it is used involve algebraic examples, such as modules over a given ring. In this talk we present an approach which allows us to construct algebraic  $K$ -theory spectra for more geometric problems, such as the Grothendieck ring of varieties, definable sets, and scissors congruence groups. One advantage of this approach is that it allows us to construct filtrations by filtering the set of generators of the groups, rather than the group itself. This last observation allows us to construct a filtration on the Grothendieck spectrum of varieties that does not (necessarily) exist on the ring.