

Miklós Abért

„The asymptotic behavior of rank.“

Let ρ be an invariant of finite volume manifolds or complexes. One can consider the limit of ρ for sequences of manifolds or complexes that converge to a limiting object. Often, one can name an analytic invariant of the limit (which is usually a (random) infinite object), where ρ is suspected to converge. Sometimes the suspicion can be proved, in some cases we even have difficulties naming the limiting invariant.

A starting positive result is Lück's Approximation Theorem that says that for a covering tower of a finite complex X converging to the universal cover of X , the normalized Betti numbers converge to the corresponding L^2 Betti numbers of X . The result generated a lot of research, by breaking apart from covering towers, and also by investigating other homological invariants, like torsion or mod p homology, and some homotopical and entropy-like invariants.

In the talk I will mainly focus on the case when ρ is the minimal number of generators (rank) of the fundamental group. One of the expected results is that for a fixed semisimple Lie group G , for any Farber sequence of lattices in G , the rank normalized by the covolume will converge to 0, except for $SL(2, \mathbb{R})$.

The results are joint work with Nikolay Nikolov, Tsachik Gelander -- Nikolay Nikolov and Laszlo Marton Toth.

Grigori Avramidi

„Exotic rationally aspherical manifolds and L^2 Betti numbers.“

Dodziuk and Singer conjectured that the L^2 Betti numbers of closed aspherical manifolds are concentrated in the middle dimension. In this talk, I will describe a construction of closed manifolds with rationally acyclic universal cover whose L^2 Betti numbers are not concentrated in the middle dimension. The construction uses rational homotopy, rational surgery, and the Davis reflection group method.

Mladen Bestvina

„Boundary amenability for $\text{Out}(F_n)$.“

The motivation for the talk is the recent result, joint with Vincent Guirardel and Camille Horbez, that $\text{Out}(F_n)$ admits a topologically amenable action on a Cantor set. This implies the Novikov conjecture for $\text{Out}(F_n)$ and its subgroups, by the work of Yu, Higson and Roe.

Most of the talk will be an introduction to boundary amenability and ways to prove it for simpler groups.

Martin Bridson

„Kähler groups and subdirect products of surfaces.“

There is much that we do not know about the class of finitely presented groups that arise as fundamental groups of compact Kähler manifolds -- ie, Kähler groups. After a brief survey, I'll describe recent work of myself and others that provides new examples of Kähler groups, on the one hand, and new obstructions to being Kähler, on the other hand. The rich subgroup structure of products of surface groups will play a prominent role in the discussion.

Joana Cirici

„Formality of symmetric monoidal functors and operads via Hodge theory.“

I will recall the notion of formal lax symmetric monoidal functor and its relation with the formality of operads and other algebraic structures. I will then prove an abstract result of "purity implies formality" in this setting. I will discuss the applications of this result to the formality of certain operads arising from algebraic geometry, and to the formality of morphisms of complex algebraic varieties in the sense of rational homotopy. The main tool in these applications is the existence of pure Hodge structures in homology. This is joint work with Geoffroy Horel.

Diarmuid Crowley

„Diffeomorphisms of discs: progress and problems.“

Let $\text{Diff}(D^k)$ be the space of diffeomorphisms of the k -disc fixing the boundary point wise. Understanding the topology of $\text{Diff}(D^k)$ is a longstanding problem in differential topology. In this talk I will give an overview of our knowledge of the homotopy groups of $\text{Diff}(D^k)$. Specifically, I will report on the existence of 8-periodic two-torsion in the homotopy groups of $\text{Diff}(D^k)$ for $k > 5$, which is detected in real K-theory. I will also discuss our (comparative) lack of knowledge concerning the Gromoll filtration and the linearisation map $\text{Diff}(D^k) \rightarrow \Omega^k(\text{SO}_k)$. This is work with Thomas Schick and Wolfgang Steimle.

Christopher Deninger

„p-adic entropy.“

This is work in progress. We discuss an improved version of entropy with values in the p-adic integers for "p-adically expansive" actions of residually finite countable groups on compact abelian groups.

It is defined as a renormalized limit of p -adic logarithms of certain Euler characteristics and it can be evaluated by a p -adic analogue of L^2 -torsion. This is similar in spirit to a result of Li and Thom who related classical entropy of algebraic actions to L^2 -torsion. For group actions by Z^n the p -adic entropy can be understood to some extent using intersection theory on arithmetic schemes.

Nigel Higson

„Geometry, noncommutative geometry and tempered representation theory.“

The tempered irreducible representations of a real reductive group were classified by the combined efforts of many people over many years, led by the extraordinary achievements of Harish-Chandra. Representation theorists have long since moved on to other challenges, but because of the complexity of subject in the state that it was left, it seems to be worthwhile to take a second look at tempered representation theory, with a view to understanding it more simply. I shall report on efforts to do this from a geometric perspective, borrowing ideas from C^* -algebras and noncommutative geometry.

Michael Hopkins

„Reflection positivity in invertible topological field theories.“

This talk will describe joint work with Dan Freed applying methods of stable homotopy theory to classification problems in condensed matter physics.

Markus Land

„A Vanishing theorem for tautological classes of aspherical manifolds.“

In this talk, I will explain a recent result about tautological, or generalised Miller--Morita--Mumford classes. These are characteristic classes of smooth fibre bundles whose fibre is a closed oriented manifold M , generalising classical characteristic numbers of M . Due to the work of Galatius and Randal-Williams much is known about tautological classes, especially if the fibre manifold is highly connected, and their work shows that tautological classes of such manifolds are often non-zero. I will discuss the contrary case where the fibre manifold M is aspherical and explain our result that for many aspherical manifolds almost all tautological classes almost vanish. Our approach relies on the Farrell--Jones conjecture and a conjecture of Burghelea's in group cohomology and I will try to carefully explain what the role of each conjecture is. This is joint work with F. Hebestreit, W. Lück, and O. Randal-Williams.

Bingbing Liang

„Dynamical correspondences of L^2 -Betti numbers.“

We investigate dynamical analogues of the L^2 -Betti numbers for modules over the integral group ring of a discrete sofic group. In particular, we use them to introduce some invariants for algebraic actions.

Clara Löh

„Approximating simplicial volumes by their integral analogs.“

The residually finite view on groups or manifolds aims at understanding groups and manifolds through gradient invariants, defined in terms of towers of finite index subgroups and finite coverings, respectively. In many cases, these gradient invariants coincide with the corresponding equivariant or dynamical versions, a prominent example being the Lück Approximation Theorem for L^2 -Betti numbers. In this talk, we will discuss positive and negative approximation results for simplicial volumes in terms of integral simplicial volumes of finite coverings.

Alex Lubotzky

„Finite transformation groups of locally symmetric spaces: on two problems of Borel.“

Let M be a locally symmetric irreducible closed manifold of dimension ≥ 3 . A result of Borel combined with Mostow rigidity imply that there exists a finite group $G = G(M)$ such that any finite subgroup of $\text{Homeo}_+(M)$ is isomorphic to a subgroup of G . Borel asked if there exist M 's with $G(M)$ trivial and if the number of conjugacy classes of finite subgroups of $\text{Homeo}_+(M)$ is finite.

We answer both questions: (1) For every finite group G there exist M 's with $G(M) = G$, and (2) the number of maximal subgroups of $\text{Homeo}_+(M)$ can be either one, countably many or continuum and we determine (at least for $\dim M$ not equal 4) when each case occurs.

Our detailed analysis of (2) also gives a complete characterization of the topological local rigidity and topological strong rigidity of proper discontinuous actions of uniform lattices in semisimple Lie groups on the associated symmetric spaces.

Based on joint works with Misha Belolipetsky and with Sylvain Cappell and Shmuel Weinberger.

Ib Madsen

„Rational Homotopy Theory of Automorphisms of Manifolds.“

The lecture will describe rational dg Lie algebra models for automorphisms of simply connected manifolds. More precisely, I will give models for the classifying space of the 1-components of the groups of homotopy automorphisms and of block diffeomorphisms, when the underlying manifold is simply connected.

The lecture represents joint work with Alexander Berglund. „Finite transformation groups of locally symmetric spaces: on two problems of Borel“

Oscar Randal-Williams

„Tautological rings.“

The cohomology of the classifying space $B\text{Diff}(M)$ of the group of diffeomorphisms of a manifold M may be considered as the ring of characteristic classes of smooth fibre bundles with fibre M . This ring is difficult to understand, but when M is an orientable surface the close connection between $B\text{Diff}(M)$ and the moduli space of Riemann surfaces means that a lot is known. In this case, algebraic geometers have found it productive to focus not on all the cohomology but a certain subring, the "tautological ring", containing the geometrically interesting classes. One can make a similar definition for manifolds of higher dimension. I will explain all these terms, and discuss some recent results on the large scale structure of these tautological rings.

Peter Teichner

„Pulling apart two 2-spheres in 4-space.“

Abstract: We use Freedman's disk embedding theorem and Whitney+Accessory spheres to show that any link map in 4-space is link homotopic to the unlink, assuming that one of the two 2-spheres is topologically embedded.

In a link homotopy, disjoint components stay disjoint at all times, even though both component go through self-intersections. This is joint work with Rob Schneiderman and applies to all (usually infinitely generated) second homotopy groups of knotted 2-spheres in 4-space.

Ulrike Tillmann

„Moduli Spaces and Operads with Homology Stability.“

For mapping class groups of surfaces it is by now well-understood that their homology stability is closely related to the fact that they give rise to an infinite loop space. Indeed, they define an operad whose algebras group complete to infinite loop spaces.

In recent work with Basterra, Bobkova, Ponto and Yeakel we define operads with homology stability more generally and prove that they are infinite loop space operads in the above sense. The strong homology stability results of Galatius and Randal-Williams for moduli spaces of even dimensions can be used to construct examples. We present some applications.

Andreas Thom

“The algebraic theory of L^2 -invariants.”

In this talk I will survey some results that emerged from Wolfgang Lück’s pioneering work on the algebraization of the theory of L^2 -invariants starting with Lück’s Approximation Theorem. We will explain a general approximation theorem for normalised Betti numbers for Farber sequences of lattices in totally disconnected groups (joint work with Roman Sauer) and work that established a conjecture by Lück concerning the vanishing of L^2 -torsion for amenable groups (joint work with Hanfeng Li). The proof of Lück’s Approximation Theorem also inspired techniques that led to the solution of Algebraic Eigenvalue Conjecture.

Marco Varisco

„Assembly maps for topological cyclic homology.“

I will present recent joint work with Wolfgang Lück, Holger Reich, and John Rognes [arXiv:1607.03557, to appear in Crelle], in which we use assembly maps to study the topological cyclic homology of group algebras. Topological cyclic homology (TC) is a far-reaching generalization of Hochschild homology and a powerful tool in algebraic K-theory. We prove that, for any finite group G , any connective ring spectrum A , and any prime p , the spectrum $TC(A[G];p)$ is determined by $TC(A[C];p)$ as C ranges over the cyclic subgroups of G . More precisely, we prove that for any finite group the assembly map with respect to the family of cyclic subgroups induces isomorphisms on all homotopy groups. For infinite groups we establish pro-isomorphism, (split) injectivity, and rational injectivity results, as well as counterexamples to injectivity and surjectivity. In particular, for hyperbolic groups and for virtually finitely generated abelian groups, we show that the assembly map with respect to the family of virtually cyclic subgroups is injective but in general not surjective, in contrast to what happens in algebraic K-theory.

Karen Vogtmann

„The borders of Outer space.“

Motivated by work of Borel and Serre on arithmetic groups, Bestvina and Feighn defined a bordification of Outer space; this is an enlargement of outer space which is highly-connected at infinity and on which the action of $\text{Out}(F_n)$ extends, with compact quotient. They use this to conclude that $\text{Out}(F_n)$ satisfies a type of duality between homology and cohomology. We show that Bestvina and Feighn's bordification can be realized as a deformation retract of Outer space instead of an extension, and use this description to study the structure of the walls at the border.

Guoliang Yu

„Algebraic K-theory and elliptic operators.“

I will discuss the computation of an index invariant of elliptic operators in the algebraic K-theory of a certain group rings and its connections to the Farrell-Jones isomorphism conjecture and the Baum-Connes conjecture. This is joint work with Zhizhang Xie.

Shmuel Weinberger

„Wolfgang Lück: A personal choice of some research highlights from his first 60 years.“