Jean-Michel Bismut. The hypoelliptic Laplacian

If X is a Riemannian manifold, the Laplacian is a second order elliptic operator on X. The hypoelliptic Laplacian $L_b|_{b>0}$ is a family of operators acting on the total space $\mathcal{X}$ of the tangent bundle TX (or of a larger vector bundle), that is supposed to interpolate between the elliptic Laplacian (when $b \to 0$) and the geodesic flow (when $b \to +\infty$). Up to lower order terms, L_b is a weighted sum of the harmonic oscillator along the fibre TX and of the generator of the geodesic flow. Every geometrically defined Laplacian, like the Hodge Laplacian in de Rham theory or in Dolbeault theory, has a natural hypoelliptic deformation.

In the talk, I will explain applications of the hypoelliptic deformation to the evaluation of orbital integrals, and also to the proof of a Riemann–Roch–Grothendieck theorem in Bott–Chern cohomology.

Lawrence Breen. Functorial homology and n-categories

I will discuss the integral homology of an abelian group A and of the Eilenberg–MacLane spaces $K(A, n)$, with emphasis on the functorial aspects, and show that this gives some insights into the structure of n-categories endowed with higher group structures.

Corrado De Concini. Generalized Steinberg section and application to branching rules

Let G be a reductive group with simply connected semisimple part, $\mathfrak{g} = Lie\, G$. We are going to show how a suitable generalization of the Steinberg section of the adjoint quotient $G \to G//G$ can be used to obtain information on how a generic irreducible representation of the quantized enveloping algebra $U_q(\mathfrak{g})$ (q is a primitive root of 1) decomposes when restricted to the quantized enveloping algebra of a Levi factor. In the special case of $G = GL(n)$ this yields a kind of Gelfand–Zeitlin phenomenon.

Christopher Deninger. Vector bundles and p-adic representations

We explain how to attach p-adic representations of a central extension of the fundamental group to vector bundles with "potentially stongly semistable reduction" on a p-adic curve.

Michael Harris. Shimura varieties and the search for a Langlands transform

The Langlands reciprocity conjectures predict the existence of a correspondence between certain classes of representations of Galois groups of number fields and automorphic representations. The study of the geometry of Shimura varieties has been central in establishing these conjectures in the cases where they are known. The talk will explain how Shimura varieties provide a link between automorphic forms and Galois theory, and will review some of the most recent results.

Roman Mikhailov. Localization, completions and metabelian groups

The talk is based on recent results obtained by the speaker jointly with G. Baumslag and K. Orr. We use so-called telescopes for studying metabelian groups. We find metabelian groups determined by their lower central quotients in the class of finitely generated residually nilpotent metabelian groups, discuss the connection of lower central series with number theory and topology.

Yurii Nesterenko. On solvability of diophantine equations in p-adic numbers

We will discuss the following phenomenon: if a system of polynomial equations with integral coefficients is solvable modulo n-th power of a prime number p, and n is an integer larger than some constant effectively dependent on degrees and heights of polynomials forming the system, then this system has a solution in p-adic numbers.

Vladimir Popov. Simple algebras and the analogue of classical invariant theory for nonclassical groups

Two topics will be discussed:

(1) If a G-module V admits a structure of a simple algebra A such that $G = \operatorname{Aut} A$, then there is a close approximation to the analogue of classical invariant theory for V.

(2) What are the groups G that appear in this way?

Peter Schneider. Iwahori–Hecke algebras are Gorenstein

In the local Langlands program the (smooth) representation theory of p-adic reductive groups G in characteristic zero plays a key role. For any compact open subgroup K of G there is a so called Hecke algebra $\mathcal{H}(G, K)$. The representation theory of G is equivalent to the module theories over all these algebras $\mathcal{H}(G, K)$. Very important examples of such subgroups K are the Iwahori subgroup I and the pro-p Iwahori subgroup I_p. By a theorem of Bernstein, the Hecke algebras of these subgroups (and many others) have finite global dimension.

In recent years the same representation theory of G but over an algebraically closed field of characteristic p has become more and more important.

But little is known yet. Again one can define analogous Hecke algebras. Their relation to the representation theory of G is still very mysterious. Moreover they are no longer of finite global dimension. In a joint work with R. Ollivier, we prove that $\mathcal{H}(G, I)$ and $\mathcal{H}(G, I_p)$ over ANY field are Gorenstein.

Yum-Tong Siu. Hyperbolicity of Generic High-Degree Hypersurfaces

We will talk about the solution of the decades-old problem of the hyperbolicity of generic hypersurfaces of sufficiently high degree and of their complements, as well as a number of related results, such as:

(i) a Big-Picard-Theorem type statement concerning extendibility, across the puncture, of holomorphic maps from a punctured disk to a generic hypersurface of high degree,

(ii) entire holomorphic functions satisfying polynomial equations with slowly varying coefficients,

(iii) Second Main Theorems for jet differentials and slowly moving targets.

Christophe Soulé. Heritage of successive minima

Given a Euclidean lattice, we describe a method to compute its successive minima. We apply this to the lattice of sections of a line bundle on an arithmetic surface.

Ulrich Stuhler. Some tame fundamental groups and their representation varieties

In this talk, based on joint work with St. Wiedmann (Göttingen), certain representation varieties of tame fundamental groups are studied. The two cases under consideration are the tame fundamental groups of projective algebraic curves over finite fields, resp. Riemann surfaces. The techniques used are appropriate versions of the Langlands correspondence, resp. theorems of Hitchin and Atiyah–Bott on moduli spaces of Higgs and ordinary vector bundles.

Michèle Vergne. An Euler–Maclaurin formula for the multiplicities of the equivariant index

Let M be a manifold with an action of a torus G. If A is an elliptic (or transversally elliptic) operator on M, invariant under G, the equivariant index of A is a virtual representation of G. We express it as a sum of characters, $\mathrm{index}(A)(g) = \sum_{\lambda \in \hat{G}} m(\lambda) g^\lambda$, and obtain a function

$$m\colon \hat{G} \to \mathbb{Z}.$$

From the Chern character of the symbol of A, we produce a piecewise polynomial function

$$M\colon Lie(G)^* \to \mathbb{R}.$$

The function M restricted to $\hat{G}$ coincides with m (under some simplifying assumptions).

This work in progress extends some common preceding work with De Concini–Procesi.

Gisbert Wüstholz. Special points on curves in products of modular curves

In the talk we report on a recent work on the André–Oort conjecture in the special case that the Shimura variety is a product of modular curves. André has shown that there are only finitely many special points. In a recent Annals paper, Kühne has given an alternative proof which is effective. We shall explain how the result can be obtained in a more systematic and therefore more elegant way. Linear forms in logarithms and the analytic subgroup theorem are the main ingredients for the proof. Our approach opens the view for trying to deal also with more general Shimura varieties.