Abstracts

Massimo Bertolini

Triple product p-adic L-functions and rational points on elliptic curves

This talk considers the arithmetic properties of the p-adic L-functions attached to triples of modular forms on the group Γ_1. It describes different connections of these p-adic L-functions with the question of constructing rational points on elliptic curves.

This is a report on joint work, partly in progress, with Marco Adamo Seveso and Rodolfo Venerucci.

Don Blasius

Complex Conjugation and Descent of Shimura Varieties

Shimura varieties are defined over a canonical number field called the reflex field. It is either totally real or a totally imaginary quadratic extension of a totally real field, i.e. a CM field. In this talk we consider only the latter case, and show that in many cases there exists a descent of the variety to the maximal totally real subfield of the reflex field. By choice, we use only of the defining group theoretic data of the variety as well as general properties of Shimura varieties, algebraic groups,etc. In other words, no reference to moduli problems is needed. The existence of these descents suggests several further problems.

This is joint work with Lucio Guerberoff.

Spencer Bloch

Motivic Gamma functions

Fibering a variety over a curve yields local systems on the curve with DR and Betti structure. The Mellin transforms of period integrals in this setting have interesting properties. The coefficients of the Taylor expansion of the Mellin transform are periods arising from the relative completion of the fundamental group of the curve in the sense of Hain and Brown.

This is joint work with M. Vlasenko.

Jean-Benoit Bost

Formal analytic arithmetic surfaces

Formal analytic arithmetic surfaces may be defined by glueing two-dimensional formal schemes over the integers and compact Rieman surfaces with boundary. Spaces of sections of vector bundles over such surfaces admit real valued invariants, their theta invariants, which are defined in terms of suitable theta series.

Formal analytic arithmetic surfaces and vector bundles over them naturally arise in diverse questions of Diophantine geometry, which may be investigated via the finiteness properties of the theta invariants of the associated spaces of sections. (Joint work with F. Charles.)

Ulrich Bunke

The descent principle and injectivity of assembly maps

Given a spectrum-valued functor on the orbit category of a group one can ask whether the assembly map for a family of subgroups has a left-inverse. In the case of finite groups I will explain an approach to this question via the descent principle. Then I discuss how the method can be extended to to infinite groups using elements of coarse geometry.

Pierre Colmez

On the p-adic etale cohomology of p-adic symmetric spaces

We will report on our ongoing analysis with G. Dospinescu and W. Niziol of the p-adic etale cohomolgy of the Drinfeld tower and its relationship with the p-adic local Langlands correspondence.

Joachim Cuntz

Free presentations as a general principle for the construction of Witt vectors, cyclic homology and rigid cohomology for commutative algebras in positive characteristic

We explain how infinitesimal cohomology, cyclic cohomology, Witt vector rings as well as rigid cohomology can all be understood naturally using suitable completions of free presentations of a given ring. When applied to commutative algebras over a field of positive characteristic, such completions lead to a good definition of cyclic homology as well as to an explicit and manifestly functorial complex computing Berthelot's rigid cohomology. The talk is mainly based on joint work with Christopher and with Cortinas-Meyer-Tamme.

Hélène Esnault

Rigid local systems and integrality

Complex irreducible rigid local systems with finite determinant and quasi-unipotent monodromies at infinity should be integral, according to Simpson's conjecture. We prove it, using Deligne's and Drinfeld's l-adic companions, that is ultimately using automorphic forms, if one replaces rigidity by cohomological rigidity.

Joint work with Michael Groechenig.

Gerd Faltings

Arakelov Theory

As it is a colloquium talk I first give an overview of Arakelov theory. Afterwards I present new results about asymptotics of Arakelov invariants on degenerating curves.

Jean-Marc Fontaine

Vector bundles and $\mathbf{Q}_p$-sheaves on p-adic fields

Let p be a prime number, K a field complete with respect to a non trivial absolute value $|\ |$ such that $|p| < 1$ and the residue field is perfect and G_K « the » absolute Galois group of K.

The category $\mathrm{Rep}_{\mathbf{Q}_p}(G_K)$ of p-adic representations of G_K can be realised as a full subcategory of two bigger abelian categories, the category $Coh(\mathcal{O}_{X_K})$ of *coherent $\mathcal{O}_{X_K}$-modules and the category $Vect^{pg}_{\mathbf{Q}_p}(K)$* of *pseudo-geometric $\mathbf{Q}_p$-sheaves over K*. I'll introduce these two categories and, in the special case where K is a finite extension of $\mathbf{Q}_p$, I'll explain that each of them can be recovered from the other by a simple construction. In this case $Vect^{pg}_{\mathbf{Q}_p}(G_K)$ is also equivalent to the category of *almost C_p-representations of G_K*.

Lars Hesselholt

Higher algebra and arithmetic

This talk concerns a twenty-thousand-year old mistake : The natural numbers record only the result of counting and not the process of counting. As algebra is rooted in the natural numbers, the higher algebra of Joyal and Lurie is rooted in a more basic notion of number which also records the process of counting. Long advocated by Waldhausen, the arithmetic of these more basic numbers should eliminate denominators. Notable manifestations of this vision include the Bökstedt-Hsiang-Madsen topological cyclic homology, which receives a denominator-free Chern character, and the related Bhatt-Morrow-Scholze integral p-adic Hodge theory, which makes it possible to exploit torsion cohomology classes in arithmetic geometry. Moreover, for schemes smooth and proper over a finite field, the analogue of de Rham cohomology in this setting naturally gives rise to a cohomological interpretation of the Hasse-Weil zeta function by regularized determinants, as envisioned by Deninger.

Steve Hurder

Symmetries of laminations

A lamination is a foliated space whose transversal space is totally disconnected. The symmetry group of a lamination consists of the foliated homeomorphisms of the space, which map each leaf to a leaf. For many laminations, its symmetry group consists only of maps which are isotopic to the identity. There is a special class of laminations, the solenoidal manifolds, whose symmetry group is much larger than this, and related to algebraic properties of the lamination. A solenoidal manifold is the inverse limit space of a tower of proper finite coverings of a manifold, and associated to such a tower is an equicontinuous minimal action of a countably-generated group on a Cantor space. The automorphism group of such an action defines a group of symmetries of the solenoidal manifold.

In this talk, we discuss some recent results in joint works with Olga Lukina, on the behavior of the group of automorphisms for minimal Cantor actions. We discuss a new property of these actions, that they are either stable or wild, a notion which reflects the degree to which the automorphism group is "exceptional". The stable/wild dichotomy is reflected in the properties of the Molino spaces associated to solenoidal manifolds by Alvarez Lopez and Moreira Galicia. The behavior is in contrast to the case for the standard theory for Riemannian foliations, where the Haefliger central sheaf is always well-defined.

These ideas are illustrated by examples from group theory, and examples constructed using properties of profinite completions of arithmetic lattices. For the solenoidal manifolds associated to the absolute Galois groups of number fields, the behavior of these symmetry groups is conjectured to be related to properties of number fields.

Uwe Jannsen

Duality for relative logarithmic de Rham-Witt sheaves and wildly ramified class field theory over finite fields, by Uwe Jannsen, Shuji Saito, Yigeng Zhao

In order to study p-adic étale cohomology of an open subvariety U of a smooth proper variety X over a perfect field of characteristic $p > 0$, we introduce new p-primary torsion sheaves. They are a modification of the logarithmic de Rham-Witt sheaves of X depending on effective divisors D supported in $X - U$.

Then we establish a perfect duality between cohomology groups of the logarithmic de Rham-Witt cohomology of U and an inverse limit of the mentioned modified sheaves. Over a finite field, the duality can be used to study wild ramification class field theory for the open subvariety U.

Masato Kurihara

zeta-elements and their integral properties

The zeta elements in this talk are elements in cohomology groups, corresponding to the zeta-values, and are generalizations of Rubin-Stark elements in the theory of Stark conjecture. I discuss their integral properties and their properties describing the Galois module structure of certain cohomology groups. I explain this theory by giving many explicit examples and relations with several conjectures.

This is joint work with D. Burns and T. Sano.

Adrian Langer

Automorphism groups and Drinfeld's half-space

The talk will be devoted to describing geometry of Drinfeld's half-space and its compactifications. In particular, I will study automorphism groups of Drinfeld's half-space and show that they form non-trivial formal schemes.

Masanori Morishita

On 3-dimensional foliated dynamical systems and Hilbert reciprocity law

This work is motivated by the question, posed by Deninger, on finding out analogies for 3-manifolds of the Hilbert symbol and the reciprocity law for number fields along the line of arithmetic topology. Our results presented in my talk are :

— to introduce local symbols and show a Hilbert type reciprocity law for 3-dimensional foliated dynamical systems, and

— to construct concrete examples of 3-dimensional foliated dynamical systems satisfying the desired properties.

This is the joint work with Junhyeong Kim, Takeo Noda and Yuji Terashima.

Alexey Parshin

Fourier analysis and Poisson formulas on discrete groups and analytic properties of zeta-functions of algebraic varieties

Let X be an algebraic variety defined over a finite field and let us consider its zeta-function defined by the Euler product. The Grothendieck cohomological method solves two main problems : meromorphic continuation of zeta-function of X to the whole s-plane and existence of a functional equation. If X is an algebraic curve then the same problems can be solved by the adelic method developed by Tate and Iwasawa. In general, zeta-function of X can be written as a sum over the discrete group of 0-cycles on X.

In the talk, we show how to develop harmonic analysis on this group for curves and apply it to study of zeta-functions. Next, we descrybe what can be done for algebraic surfaces along these lines.

Michael Rapoport

Good and semi-stable reduction of Shimura varieties

I will discuss the problem of classifying Shimura varieties with good reduction resp. with semi-stable integral models.

Shuji Saito

Rigid analytic K-theory

Let K be a field with a complete non-archimedean absolute value $|\cdot|$ and $R = \{x \in K \mid |x| \leq 1\}$ and fix $\pi \in R$ with $|\pi| < 1$. Let $\mathcal{X}$ be a (formal) scheme over R and write $\mathcal{X}_n = X \otimes_R /(\pi^{n+1})$ for $n \geq 0$. The *continuous* K-groups of $\mathcal{X}$ are defined as

$$K_i^{cont}(\mathcal{X}) := \varprojlim_n K_i(\mathcal{X}_n) \quad (i \in \mathbb{Z}) ,$$

where $K_i(\mathcal{X}_n)$ are the algebraic K-groups of $\mathcal{X}_n$. Thanks to work of Bloch-Esnault-Kerz and Morrow, the Hodge conjecture for abelian varieties has been reduced to an algebrization problem for $K_0^{cont}(\mathcal{X})$ (in case $R = \mathbb{C}[[t]]$).

In this talk I explain a joint work with Moritz Kerz and Georg Tamme on a newly developed theory of analytic K-theory $K_i^{\mathrm{an}}(X)$ for rigid spaces X over K.

The construction is done by "pro-homotopization" and "analytic Bass delooping" of BGL for affinoids, and its globalization using descent for admissible coverings. I will explain a relation of $K_i^{\mathrm{an}}(X)$ with $K_i^{cont}(\mathcal{X})$ for a formal model $\mathcal{X}$ of X over R. I will also explain a natural isomorphism $K_0(X) \simeq K_0^{\mathrm{an}}(X)$ for regular affinoid X.

Tony Scholl

Plectic cohomology of Shimura varieties

I will report on joint work with Jan Nekovár on exotic structures in the cohomology of a certain class of Shimura varieties.

Andreas Thom

Stability, cohomology vanishing, and non-approximable groups

Several well-known open questions (such as : are all groups sofic/hyperlinear ?) have a common form : can all groups be approximated by asymptotic homomorphisms into the symmetric groups Sym(n) (in the sofic case) or the finite dimensional unitary groups $U(n)$ (in the hyperlinear case) ? In the case of $U(n)$, the question can be asked with respect to different metrics and norms. We answer, for the first time, one of these versions, showing that there exist fintely presented groups which are not approximated by $U(n)$ with respect to the Frobenius norm. Our strategy is to show that some higher dimensional cohomology vanishing phenomena implies stability, that is, every Frobenius-approximate homomorphism into finite-dimensional unitary groups is close to an actual homomorphism.

Umberto Zannier

Some specialization theorems for families of abelian varieties

Consider an algebraic family $\pi : A \to S$ of abelian varieties, defined over $\overline{\mathbb{Q}}$. We shall be concerned with properties of the generic fiber of A which are preserved by taking some (or 'many') suitable special fibers. For instance, 'simplicity' is such a property, and also the endomorphism ring structure. This was shown by various authors, whose results shall be surveyed on. We shall then focus on more recent instances. One example concerns families of Pell's equations in polynomials : this can be related to hyperelliptic Jacobian-families. Another issue which we shall discuss, raised by Katz and Oort, concerns the existence of abelian varieties over $\overline{\mathbb{Q}}$ not isogenous to a Jacobian.