Prof. Dr. Werner Bley
Prof. Dr. Cornelius Greither
Prof. Dr. Gregor Kemper
Prof. Dr. Markus Land
Prof. Dr. Andreas Nickel
Prof. Dr. Andreas Rosenschon

Wintersemester 2024/25

Arithmetische und Algebraische Geometrie

Mittwoch 16-18, LMU Theresienstr. 39, Raum B251 oder TUM, Garching, Boltzmannstr. 3, Raum 02.08.020 oder UniBw

23.10.2024 Andreas Nickel (UniBw)
Title: Unramified Iwasawa theory and epsilon constants of crystalline representations
Abstract: Let K be a finite extension of $\mathbb{Q}_p$. For each de Rham representation V of G_K and finite Galois extension L of K, Fukaya and Kato have formulated a 'local epsilon constant conjecture' $C(V, L/K)$. If $L = K$ one retrieves a conjecture of Fontaine and Perrin-Riou, which can be formulated in terms of Tamagawa numbers. For a certain class of crystalline representations, we study the compatibility of the conjectures $C(V, L_n/K)$, where L_n denotes the n-th layer in the unramified $\mathbb{Z}_p$-extension of L, with twisting by unramified representations. This is joint work with David Burns.

30.10.2024 Daniel Kriz (Orsay)
ACHTUNG: Vortrag an der der UniBw, Raum 0401 (Gebäude 33).
Vortragsbeginn: 17 Uhr.

Title: Horizontal p-adic L-functions and applications to central values of (derivatives of) L-functions
Abstract: Given a positive integer d, a fundamental question in algebraic and analytic number theory is to determine how many order d character twists of a central L-value or derivative of a modular form are non-vanishing. For $d = 2$ this question is addressed by Goldfeld's conjecture, where substantial progress has been made in recent years via analytic number-theoretic and Iwasawa-theoretic techniques. For $d > 2$, a conjecture of David-Fearnley-Kisilevsky predicts 100% non-vanishing of order d twists, but little was previously known toward this conjecture. In this talk I will describe a novel approach to these questions using a new construction called horizontal p-adic L-functions. The non-vanishing of these functions is related to Kolyvagin's conjecture and similar questions in the theory of Euler systems. Using a structure theorem for horizontal Iwasawa algebras we give strong lower bounds on the non-vanishing of order d twists of L-values of newforms and their derivatives, as well as similar lower bounds on simultaneous non-vanishing. For 100% of elliptic curves we improve the previous best-known lower bounds in the $d = 2$ case due to Ono ($r = 0$) and Kumar-Mallesham-Sharma-Singh ($r = 1$), giving the best general results toward Goldfeld's conjecture and the first general results toward David-Fearnley-Kisilevsky's conjecture. This is joint work with Asbjørn Nordentoft.

06.11.2024 .
        Title:
        Abstract:

13.11.2024 Artem Lopatin (University of Campinas)
        Title: G_2-orbits of several octonions.
        Abstract: We work over an algebraically closed field of an arbitrary characteristic. The group of automorphisms of the algebra of octonions is the simple exceptional algebraic group G_2. We describe a separating set for G_2-invariants of several copies of the algebra of octonions over a field of characteristic two. We also describe a minimal separating and a minimal generating sets for G_2-invariants of several copies of the algebra of octonions in case of a field of odd characteristic. We present classification of pairs of octonions with respect to the G_2-action and describe the closures of G_2-orbits of pairs of octonions in Zariski topology. Finally, we consider an application to linear equations over octonions.

20.11.2024 Fabian Gundlach (Paderborn)
        Title: Symmetries of the set of squarefree integers in a number field
        Abstract: Let K be a number field. We answer the following question and several generalizations: What are the $\mathbb{Z}$-linear maps $\mathcal{O}_K \longrightarrow \mathcal{O}_K$ that send every squarefree algebraic integer to a squarefree algebraic integer? As an application to dynamical systems, we then compute the extended symmetry group of the shift space associated to the set of squarefree integers.

27.11.2024 Katharina Müller (UniBw)
        Title: Hilbert's 10th Problem for families of $\mathbb{Z}_p$ extensions over imaginary quadratic fields
        Abstract: Hilbert's 10th problem asks whether there is an algorithm that decides whether a given diophantine equation over the ring of integers of a number field has a solution. It is a conjecture due to Denef and Lipshitz that this question has a negative answer for all number fields. Their conjetrure is known for imaginary quadratic fields. Using a characterization of Hilbert's 10th problem in terms of elliptic curves due to Shlapentokh we will construct infinite families of fields for which Hilbert's 10th problem has a negative answer. This is joint work with Anwesh Ray.

04.12.2024 Özgür Bayindir (LMU)
        Title: Algebraic K-theory and chromatic redshift
        Abstract: I will begin with an introduction to algebraic K-theory, ring spectra and the chromatic redshift conjecture. After this, I will talk about our new proof of the redshift conjecture for Lubin-Tate spectra and our algebraic K-theory computations.

        This work is partially joint with Christian Ausoni and Tasos Moulinos.

11.12.2024 Paul Ziegler (TU Darmstadt)
        Title: p-adic integration on Artin stacks
        Abstract: The technique of p-adic integration allows one to obtain cohomological information about algebraic varieties via arithmetic methods. After giving an introduction to this technique, I will explain how it can be extended to Artin stacks, and give an application to BPS-invariants from enumerative geometry. This is joint work with M. Groechenig and D. Wyss.

18.12.2024 Daniel Macias Castillo (ICMAT Madrid)
        Title: The refined class number formula for Drinfeld modules
        Abstract: In 2012, Taelman proved an analogue of the Analytic Class Number Formula, for the Goss L-values that are associated to Drinfeld modules. He also explicitly stated that 'it should be possible to formulate and prove an equivariant version' of this formula.

In joint work with María Inés de Frutos Fernández and Daniel Martínez Marqués, we formulate and prove an equivariant, or 'refined', version of Taelman's formula.

In this talk we will review Taelman's work and discuss the formulation of the refined formula, as well as some additional explicit consequences. If time permits, we will also briefly touch on related work in progress.

08.01.2025 .
Title:
Abstract:

15.01.2025 Bence Forras (UniBw)
Title: Signed Selmer groups of supersingular elliptic curves over weakly ramified base fields
Abstract: Let E be an elliptic curve over a number field, and let $p \geq 5$ be a prime of good supersingular reduction. We consider signed Selmer groups of E over a base field K. As opposed to existing work on the subject, we do not assume that supersingular places are unramified in $K/\mathbb{Q}$, instead allowing weak ramification at these places. Studying the cohomology of signed Selmer groups, we derive a Kida formula and an integrality result for characteristic elements in this context. This is joint work with Katharina Müller.

22.01.2025 Jan Vonk (Universiteit Leiden)
Title: Rational points and geodesics on modular curves
Abstract: As part of a systematic computational study of equivalence classes of binary quadratic forms, Gauss stated several conjectures on their class numbers. In this talk, I will discuss some recent results related to these conjectures. We will begin with the case of negative discriminants, and its intimate connection with the important but challenging problem of finding rational points on modular curves with non-split Cartan level structures. We then turn to the more mysterious case of positive discriminants, where much less is known. The key missing notion is that of singular moduli for real quadratic fields, which is the subject of recent joint work with Darmon.

29.01.2025 Sebastian Petersen (Universität Kassel)
Title: Varieties with the weak Hilbert property
Abstract: Hilbert's irreducibility theorem, which is a statement about rational points on finite covers of the projective line $\mathbb{P}^1_{\mathbb{Q}}$, is one of the fundamental results in diophantine geometry with plenty of applications throughout algebra. It led Colliot-Thèléne and Sansuc in the 80s to the definition of varieties with the Hilbert property (HP). It turns out, however, that this is a quite restricted class of varieties: If a variety over a number field satisfies (HP), then its geometric fundamental group is trivial according to a recent theorem of Corvaja and Zannier. This led Corvaja and Zannier in 2017 to the definition of the so-called weak Hilbert property (WHP), which suffices for many applications and is enjoyed by a much larger class of varieties. The class of WHP varieties has been studied extensively since then by many people. The aim of my talk is to survey this development. In particular I will report on recent joint work with Bary-Soroker and Fehm concerning permanence principles for WHP varieties under extension of the ground field. There exist interesting links with a diophantine conjecture of Zannier, back from 2010. Joint work with Gajda, based on the results with Bary-Soroker and Fehm, led to a partial result on that. The whole subject is subordinate to the following question: Ratonal points are - to a reasonable extent - well-understood for subvarieties of abelian varieties thanks to seminal work of Faltings on the Mordell-Lang conjecture. But what about other varieties, e.g. coverings of abelian varieties?

05.02.2025 .
Title:
Abstract: