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 23/24

Arithmetische und Algebraische Geometrie

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

18.10.2023 Florian Griesser (LMU München)

Title: On the 2-part of the BSD-conjecture for elliptic curves with CM

Abstract: In the first half of the 1960s Birch and Swinnerton-Dyer developed their famous conjecture, which claims a close connection between the arithmetic and analytic properties of $L(E, s)$ (at $s = 1$) for an elliptic curve E defined over $\mathbb{Q}$. Down to the present day this conjecture is still unproved. For elliptic curves with complex multiplication by the maximal order of an imaginary quadratic field, John Coates analyzed the 2-adic valuation of the algebraic part of the L-series at $s = 1$. For quotients with special quadratic twists, he proved an inequality for the 2-adic valuation of the Tamagawa numbers for the twisted curve. This is in close connection to the 2-part of the BSD-conjecture, which predicts the difference in the inequality to be determined by the Shafarevich-Tate group.

This is the defense of my master's thesis, which is based on a paper of John Coates. In this thesis I analyzed the results of Coates and recomputed the numerical examples using the computer algebra system MAGMA.

25.10.2023 Katharina Müller (UniBw München)

Title: On towers of isogeny graphs with full level structure

Abstract: Let k be a finite field of chracteristic q. Let p, l be primes coprime to q and let N be a positive integer coprime to pql. In this talk we will define graphs $X_l^q(Np^n)$ whose vertices are tuples (E, P, Q), where E/k is an elliptic curve and P, Q is a basis for $E[Np^n]$. The edges are given by degree l isogenies. We will discuss when $X_l^q(Np^n)/X_l^q(Np^{n-1})$ is Galois and will describe the structure of these graphs as volcanos.

This is joint work with Antonio Lei.

08.11.2023 Daniel Schaeppi (Regensburg)

Title: Symplectic K-theory and stably free modules

Abstract: The low-dimensional symplectic K-groups can be defined by replacing the general linear group with the symplectic group in the definition of the ordinary K-groups. Similar tools are available for their study, for example so called analytic patching diagrams. These patching diagrams can be used to relate some classical questions about stably free modules to symplectic K-theory.

Combining this with recent developments in hermitian K-theory for rings where 2 is not assumed to be a unit, we are able to settle the following open question. We call a ring Hermite if all stably free modules over it are free. The Hermite ring conjecture is the conjecture that the polynomial ring over a Hermite ring is again Hermite. With the above mentioned tools, we can construct a counterexample to the Hermite ring conjecture in characteristic 2.

15.11.2023 Georg Tamme (Mainz)
Title: On the vanishing of negative K-groups
Abstract: The negative algebraic K-groups of a scheme encode some information about its geometry. For example, they vanish when the scheme is regular. In this talk, I will discuss the following vanishing result for negative K-groups: For any quasi-compact, quasi-separated scheme X, the K-groups $K_i(X)$ vanish for i less than the negative valuative dimension of the scheme. The valuative dimension is a variant of the Krull dimension introduced by Jaffard in 1960 which still behaves well for non-Noetherian schemes. The main new ingredient in the proof is a descent result for algebraic K-theory under abstract blowups in the non-Noetherian setting. This is joint work with Shane Kelly and Shuji Saito and also based on earlier joint work with Markus Land, and with Moritz Kerz and Florian Strunk.

22.11.2023 Ute Ludwig (LMU München)
Title: Der Satz von Ferrero-Washington
Abstract: Der Satz von Ferrero-Washington besagt, dass Iwasawas μ-Invariante für die zyklotomische $\mathbb{Z}_p$-Erweiterung jedes absolut abelschen Zahlkörpers verschwindet. Neben dem Beweis von Ferrero und Washington (1979) gibt es dafür einen weiteren Beweis von Sinnott (1984), die beide im Vortrag skizziert werden. Dieser Vortrag findet im Rahmen meiner Masterarbeit statt.

29.11.2023 Stephan Elsenhans (Universität Würzburg)
Title: Cubic surfaces – moduli spaces and arithmetic
Abstract: The study of cubic surfaces and in particular the structure of the 27 lines on the surface is classical. From an arithmetic perspective, the Galois action on the lines plays an important role. In this talk we will inspect several descriptions of the moduli space of cubic surfaces. Based on this I will explain how to construct cubic surfaces with a prescribed Galois action on the 27 lines.

06.12.2023 .
Title:
Abstract:

13.12.2023 Wolfgang Lück (Bonn)
Title: On the K-theoretic Farrell-Jones Conjecture for Hecke algebras of reductive p-adic groups
Abstract: We formulate and sketch the proof of the K-theoretic Farrell-Jones Conjecture for the Hecke algebra of reductive p-adic groups. This is the first time that a version of the Farrell-Jones Conjecture for topological groups is formulated. It implies that the reductive projective class group of the Hecke algebra of a reductive p-adic group is the colimit of these for all compact open subgroups. This has been proved rationally by Bernstein and Dat using representation theory. The main applications of our result will concern the theory of smooth representations. In particular we will prove a conjecture of Dat.

20.12.2023 .
Title:
Abstract:

10.01.2024 .
Title:
Abstract:

17.01.2024 Martin Kreuzer (Universität Passau)
ACHTUNG: Der Vortag findet in GARCHING statt!!!
Uhrzeit: 17:15, TUM Boltzmannstr. 3, Raum 02.08.020.
Kaffee und Tee: 16:45 in Raum 02.08.021

Title: On Border Basis Schemes
Abstract: One of the key features of Algebraic Geometry is the existence of moduli spaces, i.e., of schemes whose closed points correspond to certain types of algebraic varieties or schemes. An intensely studied case is the Hilbert scheme $Hilb^{\mu}(\mathbb{P}^n_K)$ parametrizing 0-dimensional subschemes of a fixed projective space over a field K. Performing explicit computer calculations for these schemes has been notoriously difficult, because the presentations of their coordinate rings provided by Grothendieck's construction are hard to make explicit and involve large numbers of indeterminates and defining equations.

Here border basis schemes come to the rescue. For an order ideal $\mathcal{O}$ of terms, i.e., for a divisor-closed finite set of terms, the border basis scheme $\mathbb{B}_{\mathcal{O}}$ parametrizes all 0-dimensional affine schemes for which the terms in $\mathcal{O}$ define a K-vector space basis of their coordinate ring. These schemes form an open covering of the Hilbert scheme and have explicitly describable, well-manageable defining equations.

After recalling the construction and some basic properties of border basis schemes, we survey some recent joint work with Lorenzo Robbiano (Genova) and Le Ngoc Long (Hue) concerning their computational aspects. We consider important subschemes of $\mathbb{B}_{\mathcal{O}}$ such as the homogeneous border basis scheme, the maxdeg border basis scheme, and various subschemes parametrizing properties such as being locally Gorenstein, strictly Gorenstein, strict complete intersections, having the Cayley-Bacharach property, etc.

The last topic is a new technique, called Z-separating embeddings, for re-embedding schemes from high-dimensional spaces into lower-dimensional spaces which avoids the potentially costly calculation of Gröbner bases and allows us, for instance, to prove that certain border bases schemes are isomorphic to affine spaces and some are not.

24.01.2024 Robert Pollack (Boston University).
ACHTUNG: Dieser Vortrag findet an der UniBw statt. Raum: HS 033-0401
BEGINN: 17:15 Uhr !!!

Title: Slopes of modular forms and the ghost conjecture
Abstract: Modular forms are holomorphic functions with a wealth of symmetries. Even though these functions are borne out of complex analysis, their Fourier coefficients contain a wealth of arithmetic information. Even bounding the sizes of these coefficients involve very deep mathematics – the best bounds follow from Deligne's proof of the Weil conjectures, for which he was awarded the Fields medal.

In this talk, rather than looking at complex absolute values, we will instead focus on the p-adic size of p-th Fourier coefficient for a prime number p. We will state a conjecture (the ghost conjecture) which gives an exact description of these sizes for all modular forms. This funnily named conjecture converts difficult automorphic questions into more accessible combinatorial ones. We will discuss the state of this conjecture and its applications to several open questions on slopes of modular forms.

31.01.2024 Luca Marannino (Duisburg-Essen).
Title: A p-adic explicit reciprocity law for diagonal classes

Abstract: Theorems known as reciprocity laws are ubiquitous in number theory. In this talk, I will discuss a p-adic reciprocity law that shall appear in my PhD thesis. This explicit reciprocity law relates certain diagonal classes on a triple product of modular curves to p-adic special values of a suitable p-adic L-function, extending work of Darmon-Rotger and Bertolini-Seveso-Venerucci. I will present this result and, time permitting, I will try to explain how it fits into a p-adic method that could allow to shed some light on certain instances of the Birch and Swinnerton-Dyer conjecture.

07.02.2023 Stefan Schreieder (Hannover)
Title: Cycle conjectures and birational invariants over finite fields
Abstract: We discuss relations between cycle conjectures over finite fields, such as the Tate, Beilinson, and GrothendieckSerre semi-simplicity conjectures, and certain birational invariants of projective space. This is joint work with Samet Balkan.