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Wintersemester 20/21

**Arithmetische und Algebraische Geometrie**  
Mittwoch 16-18, Theresienstr. 39, B 251 (zur Zeit online)

11.11.2020 Nils Ellerbrock (Universität Duisburg-Essen).

Title: Integrality of Stickelberger elements

Abstract: Let  $L/K$  be a Galois extension of number fields with Galois group  $G$ . Using  $L$ -values at zero, one can construct so-called Stickelberger elements in the center of the group algebra  $\mathbb{Q}[G]$ . If  $G$  is abelian, one knows by independent work of Deligne–Ribet and Cassou-Nogues that these elements indeed have integral coefficients. However, this is not true in general. In this talk we present new results on the integrality of Stickelberger elements. Assuming a certain integrality conjecture, we propose a new construction of  $p$ -adic Artin  $L$ -functions for non-linear characters. This also provides new evidence for a conjecture of Gross.

18.11.2020 Johannes Sprang (Universität Regensburg)

Title: (Ir)rationality of Hecke  $L$ -values.

Abstract: Euler's beautiful formula

$$\zeta(2n) = -\frac{(2\pi i)^{2n}}{2(2n)!} B_{2n}.$$

can be seen as the starting point of the investigation of special values of  $L$ -functions. In particular, Euler's result shows that all critical zeta values are rational up to multiplication with a particular period, here the period is a power of  $(2\pi i)$ . Conjecturally this is expected to hold for all critical  $L$ -values of motives. In this talk, we will focus on  $L$ -functions of number fields. In the first part of the talk, we will discuss the 'critical' and 'non-critical'  $L$ -values exemplary for the Riemann zeta function. Afterwards, we will head on to more general number fields and explain a joint result with Guido Kings on the algebraicity of critical Hecke  $L$ -values for totally imaginary fields up to explicit periods.

25.11.2020 Katharina Müller (Universität Göttingen)

Title: The vanishing of  $\mu$  for the split prime  $\mathbb{Z}_p$ -extension of imaginary quadratic number fields

Abstract: Let  $\mathbb{K}$  be an imaginary quadratic field and  $p \in \mathbb{Z}$  a rational prime that splits in  $\mathbb{K}$ . Let  $\mathfrak{p}$  be one of the prime ideals above  $p$ . By class field theory there exists a unique  $\mathbb{Z}_p$ -extension  $\mathbb{K}_\infty/\mathbb{K}$  that is unramified outside  $\mathfrak{p}$ . Let  $\mathbb{L}$  be an arbitrary finite abelian extension of  $\mathbb{K}$  and define  $\mathbb{L}_\infty := \mathbb{K}_\infty \mathbb{L}$ . Let  $\mathbb{M}_\infty$  be the maximal  $p$ -abelian extension of  $\mathbb{L}_\infty$  unramified outside  $\mathfrak{p}$ . Generalizing the work of Leila Schneps we will show that  $\text{Gal}(\mathbb{M}_\infty/\mathbb{K}_\infty)$  is a finitely generated  $\mathbb{Z}_p$ -module. This fact makes the classical approach to prove the Iwasawa main conjecture accessible and allows us to express the characteristic ideal of  $\text{Gal}(\mathbb{M}_\infty/\mathbb{L}_\infty)$  in terms of  $p$ -adic  $L$ -functions. This is joint work with Vlad Crisan.

- 02.12.2020 Daniele Agostini (MPI Leipzig)  
 Title: On the irrationality of moduli spaces of K3 surfaces.  
 Abstract: In this talk, we consider quantitative measures of irrationality for moduli spaces of polarized K3 surfaces of genus  $g$ . We show that, for infinitely many examples, the degree of irrationality is bounded polynomially in terms of  $g$ , so that these spaces become more irrational, but not too fast. The key insight is that the irrationality is bounded by the coefficients of a certain modular form of weight 11. This is joint work with Ignacio Barros and Kuan-Wen Lai.
- 09.12.2020 Ulrike Riess (ETH Zürich)  
 Title: On the Kähler cone of irreducible symplectic orbifolds  
 Abstract: In this talk I report on recent joint work with G. Menet: We generalize a series of classical results on irreducible symplectic manifolds to the orbifold setting. In particular we prove a characterization of the Kähler cone using wall divisors. This generalizes results of Mongardi for the smooth case. I will finish the talk by applying these results to study a concrete example.
- 16.12.2020 Gautier Ponsinet (MPI Bonn)  
 Title: Universal norms of  $p$ -adic Galois representations and the Fargues-Fontaine curve  
 Abstract: In 1996, Coates and Greenberg computed explicitly the module of universal norms associated with an abelian variety in a perfectoid field extension. The computation of this module is essential to Iwasawa theory, it was notably later used by Greenberg to prove "control theorems" for Selmer groups generalising Mazur's foundational work on the Iwasawa theory of abelian varieties over  $\mathbb{Z}_p$ -extensions. Coates and Greenberg then raised the natural question on possible generalisations of their result to general motives. In this talk, I will present a new approach to this question relying on the classification of vector bundles over the Fargues-Fontaine curve, which enables to answer Coates and Greenberg's question affirmatively in new cases.
- 13.01.2021 .  
 Title:
- 20.01.2021 .  
 Title:
- 27.01.2021 Fabio Ferri (University of Exeter)  
 Title: On reduction steps for Leopoldt's conjecture  
 Abstract: Let  $p$  be a rational prime and let  $L/K$  be a Galois extension of number fields with Galois group  $G$ . Under some hypotheses, we show that Leopoldt's conjecture at  $p$  for certain proper intermediate fields of  $L/K$  implies Leopoldt's conjecture at  $p$  for  $L$ ; a crucial tool will be the theory of norm relations in  $\mathbb{Q}[G]$ . We also consider relations between the Leopoldt defects at  $p$  for intermediate extensions of  $L/K$ , noting that Leopoldt kernels form a cohomological Mackey functor. We finally show that our results combined with some techniques introduced by Buchmann and Sands allow us to find infinite families of nonabelian totally real Galois extension of  $\mathbb{Q}$  satisfying Leopoldt's conjecture for certain primes. This is joint work with Henri Johnston.
- 03.02.2021 Frank Gounelas (Universität Göttingen).  
 Title: Curves of maximal moduli and symmetric differentials on K3s  
 Abstract: Finishing work of Bogomolov, Hassett, Li, Liedtke, Mumford, Tschinkel and others, it was recently proved by Chen-Gounelas-Liedtke that every complex projective K3 surface contains infinitely many rational curves. With this as a starting point I will discuss recent work with Xi Chen proving, as an application of the Bogomolov-Miyaoka-Yau inequality and rudimentary analysis of singularities of the rational curves, how one

can in fact produce curves of arbitrary genus which vary maximally in the moduli space of curves. This generalisation has interesting applications to the existence of differential forms, stability of the tangent bundle and study of 0-cycles on K3s.

10.02.2021 .  
Title:

22.01.2020 .  
Title: