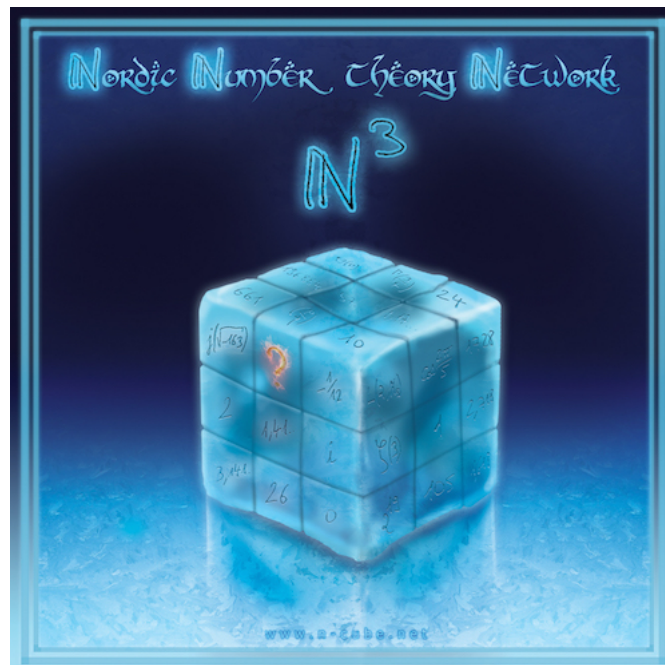


N-cube days VIII/N-cube week
@Institut Mittag-Leffler

June 25-29, 2018



Practical information:

The following details some particularities of the conference.

- On Wednesday afternoon, we plan an excursion event for anyone who is interested.
- On Thursday, at 19h, there will be a conference dinner at the premises.
- During the conference we have tried to prioritize the maximum number of participants. In practical terms this means that there might some days with more people attending that there are seats at the lunch organized by the Institut Mittag-Leffler. We hope that we can, in case this happens, in the spirit of collegiality resolve it by having some people eat out in the surrounding area.

About the network

The Nordic Number Theory Network (N-cube) started up in 2014 as a collaboration between the University of Copenhagen and Chalmers/the University of Gothenburg. The aim was to organize joint seminars and workshops, and to encourage and stimulate mobility of researchers and students in Number Theory and Arithmetic Geometry in the nordic countries. Over the last 4 years, the network has expanded considerably, adding several universities in Denmark, Finland, Norway and Sweden as new active nodes.

The central activity in the network is a two day workshop titled *N-cube days*. This event takes place twice a year, each time offering 7-8 speakers, both from within the network as well as international guests, presenting new results in a wide range of topics. So far, the N-cube days have been held in Copenhagen, Gothenburg and Stockholm, and will for the first time be organized in Lund in November 2018. Additionally over the last 4 years, there has been numerous sporadic workshops in the nordic countries organized by members of the network.

Speakers and abstracts:

	Monday	Tuesday	Wednesday	Thursday	Friday
7-30 - 9.00, Breakfast					
9.30-10.30	Kiming	Strömbergsson	Nicaise	Bruinier	Kowalski
11.00-12.00	Herrero	David	Holmström	Klurman	Persson
12.00 - 14.00, Lunch					
14.00-15.00	Wittenberg	Fresán		Fintzen	Ernvall-Hytönen
15.15-16.15	Shokrieh	Matthiesen		Johansson	Bergh
19.00-				Dinner	

Monday

Modular forms modulo prime powers

Ian Kiming, *Copenhagen University*

Abstract: I will review basic questions and results from recent years in the theory of modular forms modulo prime powers. This will include a discussion of some of the most basic motivating questions. For the results, I will mostly focus on the work of myself and my co-authors.

A Jensen-Rohrlich type formula for the hyperbolic 3-space

Sebastián Herrero, *University of Gothenburg and Chalmers University of Technology*

Abstract: The classical Jensen's formula is a well-known theorem of complex analysis which characterizes, for a meromorphic function f on the unit disc, the value of the integral of $\log |f(z)|$ on the unit circle in terms of the zeros and poles of f inside the unit disc. An important theorem of Rohrlich establishes a version of Jensen's formula for modular functions f with respect to the full modular group $PSL_2(\mathbb{Z})$ and expresses the integral of $\log |f(z)|$ over the corresponding modular curve in terms of special values of Dedekind's eta function. In this talk I will present a Jensen-Rohrlich type formula for certain family of functions defined in the hyperbolic 3-space which are automorphic for the group $PSL_2(\mathcal{O}_K)$ where \mathcal{O}_K denotes the ring of integers of an imaginary quadratic field. This is joint work with Ö. Imamoglu (ETH Zurich), A.-M. von Pippich (TU Darmstadt) and Á. Tóth (Eotvos Lorand Univ.).

Zero-cycles on homogeneous spaces of linear groups

Olivier Wittenberg, *École Normale Supérieure*

Abstract: (Joint work with Yonatan Harpaz.) The Brauer-Manin obstruction is expected to control the existence and weak approximation properties of rational points on homogeneous spaces of linear algebraic groups over number fields. We establish the zero-cycle variant of this conjecture. The same method also leads to a new proof of Shafarevich's theorem that finite nilpotent groups are Galois groups over any number field.

Heights and tropical geometry

Farbod Shokrieh, *Cornell University*

Abstract: Given a principally polarized abelian variety A over a number field (or a function field), one can naturally extract two real numbers that capture the "complexity" of A : one is the Faltings height and the other is the Néron-Tate height (of a symmetric effective divisor defining the polarization). I will discuss a precise relationship between these two numbers, relating them to some subtle invariants arising from tropical geometry (more precisely, from Berkovich analytic spaces). (Joint work with Robin de Jong.)

Tuesday

Twist-minimal trace formulas and the Selberg eigenvalue conjecture

Andreas Strömbergsson, *Uppsala University*

Abstract: I will describe recent joint work with Andrew Booker and Min Lee where we derive a fully explicit version of the Selberg trace formula for twist minimal Maass forms of weight 0 and arbitrary conductor and nebentypus character, and apply it to prove two theorems. First, conditional on Artin's conjecture, we classify the even 2-dimensional Artin representations of small conductor; in particular, we show that the even icosahedral representation of smallest conductor is the one found by Doud and Moore (2006), of conductor 1951. Second, we verify the Selberg eigenvalue conjecture for groups of small level, improving on a result of Huxley from 1985.

Moments of cubic Dirichlet twists over function fields (Joint work with A. Florea and M. Lalin).

Chantal David, *Concordia University*

Abstract: We present in this talk some results about the first moment of cubic twists of Dirichlet L -functions over the function field $\mathbb{F}_q(T)$, when $q \equiv 1 \pmod{3}$. In this case, the ground field contains all third roots of 1, and the cubic twists are given by Kummer theory. We first explain the history of the problem and the standard conjectures for moments of L -functions, and present the previous results, over number fields and function fields. The case of cubic twists over number fields was considered in previous work, but never for the full family over a field containing the third roots of unity.

Hodge theory of Kloosterman sums

Javier Fresán, *École Polytechnique*

Abstract: Recently, Broadhurst and Roberts studied the global L -functions associated with symmetric powers of Kloosterman sums and conjectured a functional equation after extensive numerical computations. By the work of Yun, these L -functions correspond to "usual" motives over \mathbb{Q} which, in low degree, are known to be modular. For the purpose of computing the Hodge numbers or relating the special values of the L -functions to periods, it is however more convenient to change gears and work with exponential motives. I will construct the relevant motives and show how the irregular Hodge filtration allows one to explain the gamma factors at infinity in the functional equation. Based on joint work with Claude Sabbah and Jeng-Daw Yu.

Correlations of multiplicative functions and applications

Lilian Matthiesen, *KTH*

Abstract: In the first part of this talk I will describe asymptotic results on linear correlations of the form $\sum_{n,d < x} h_1(n)h_2(n+d)\dots h_{r+1}(n+rd)$ (and generalisations thereof) for multiplicative functions h_1, \dots, h_{r+1} . The proof of these results works with methods developed by Green and Tao in their work on primes and uses, amongst others, results stemming from Granville and Soundararajan's work on "pretentiousness". The second part of the talk is about joint work with Daniel Loughran on the problem of counting the number of varieties in a given family which have a rational point. Building partly on the above-mentioned results about multiplicative functions, we obtain correct order lower bounds for this counting problem in suitable families over \mathbb{P}^1 , and thereby answer a question of Serre.

Wednesday

Specialization of (stable) rationality in families with mild singularities

Johannes Nicaise, *Imperial College*

Abstract: I will present joint work with Evgeny Shinder, where we use Denef and Loeser's motivic nearby fiber and a theorem by Larsen and Lunts to prove that stable rationality specializes in families with mild singularities. I will also discuss an improvement of our results by Kontsevich and Tschinkel, who defined a birational version of the motivic nearby fiber to prove specialization of rationality.

Around motives and multiplicative functions

Andreas Holmström, *Stockholm University*

Abstract: I will give an elementary introduction to the theory of motives. In the process we will encounter a variety of problems and results related to multiplicative functions, q -series, and computer-automated theorem-proving in number theory.

Thursday

Generating series of special divisors on arithmetic ball quotients

Jan Hendrik Bruinier, *TU Darmstadt*

Abstract: A celebrated result of Hirzebruch and Zagier states that the generating series of Hirzebruch-Zagier divisors on a Hilbert modular surface is an elliptic modular form with values in the cohomology. We discuss some generalizations and applications of this result. In particular, we report on recent joint work with B. Howard, S. Kudla, M. Rapoport, and T. Yang, in which we prove an analogue for special divisors on integral models of ball quotients. In this setting the generating series takes values in an arithmetic Chow group in the sense of Arakelov geometry. If time permits, we address some applications to arithmetic theta lifts and the Colmez conjecture.

Mean values of multiplicative functions over the function fields

Oleksiy Klurman, *KTH*

Abstract: Understanding mean values and correlations of multiplicative functions over number fields plays key role in analytic number theory. Motivated by the recent work of Granville, Harper and Soundararajan we discuss mean values of multiplicative functions over the function fields $\mathbb{F}_q[x]$. In particular, we prove stronger function field analogs of several classical results due to Wirsing, Halasz, Hall, Tenenbaum explaining some surprising features that are not present in the number field setting. Our main result describes spectrum of multiplicative functions over the function fields. This is based on joint works with C. Pohoata (Caltech) and K. Soundararajan (Stanford).

Representations of p -adic groups

Jessica Fintzen, *University of Michigan*

Abstract: The building blocks for complex representations of p -adic groups are called supercuspidal representations. I will survey what is known about the construction of supercuspidal representations, mention questions that remain mysterious until today, and explain some recent developments. (I will not assume that the audience knows supercuspidal representations.)

Vanishing theorems for Siegel modular varieties of infinite Γ_1 -level

Christian Johansson, *Cambridge*

Abstract: I will discuss a vanishing theorem for singular/etale cohomology with \mathbb{F}_p -coefficients as one takes the direct limit over the tower of Siegel modular varieties with $\Gamma_1(p^n)$ -level structure. I will focus on the geometry that goes into the proof; if there is time I will talk about an application to Scholze's construction of Galois representations for torsion classes. This is joint work with Caraiani, Gulotta, Hsu, Mocz, Reinecke and Shih.

Friday

Unorthodox non-vanishing theorems for twisted L-functions

Emmanuel Kowalski, *ETH, Zürich*

Abstract: (joint with V. Blomer, É. Fouvry, Ph. Michel, D. Milicevic and W. Sawin)
Non-vanishing results for special values of families of L-functions are important statements that often have interesting interpretations or applications, and that measure our understanding of the underlying objects. The talk will present the general context and some of the analytic methods that exist to obtain non-vanishing theorems, and will then discuss a recent unusual type of such a theorem for the family of twists of a fixed modular form by Dirichlet characters of large level, where the work of Katz on distribution properties of discrete Mellin transforms plays a key role. .

Degenerate Whittaker models and small automorphic representations

Daniel Persson, *University of Gothenburg and Chalmers University of Technology*

Abstract: I will start with an introduction to certain aspects of the theory of automorphic representations, with emphasis on the Fourier-Whittaker coefficients attached to so called degenerate Whittaker models. I will then focus “small” representations and discuss recent results on minimal and next-to-minimal representations of simple Lie groups. This is joint work with Gourevitch, Gustafsson, Kleinschmidt, Liu and Sahi.

An improvement of the transcendence measure of e (joint work with Louna Seppälä and Tapani Matala-aho)

Anne-Maria Ernvall-Hytönen, *Åbo Akademi University*

Abstract: A transcendence measure measures the smallest possible size of the expression $|P(e)|$ where $P(e)$ is a polynomial with integer coefficients. This measure depends on the degree of the polynomial and on the maximal height of the coefficients. To be more precise, Let $m, H \geq 1$ be given and define $\omega(m, H)$ as the infimum of the numbers $r > 0$ satisfying the estimate

$$|\lambda_0 + \lambda_1 e + \lambda_2 e^2 + \dots + \lambda_m e^m| > \frac{1}{H^r},$$

for all $\bar{\lambda} = (\lambda_0, \dots, \lambda_m)^T \in \mathbb{Z}^{m+1} \setminus \{\bar{0}\}$ with $\max_{1 \leq i \leq m} \{|\lambda_i|\} \leq H$. Then any function greater than or equal to $\omega(m, H)$ may be called a transcendence measure for e . The quest for finding good transcendence measures for e started with Borel in 1899, when he proved that $\omega(m, H)$ is smaller than $c \log \log H$ for some constant c depending on m . This bound has been proved by several people, including Popken (1928–1929), Mahler (1931), Khassa and Srinivasan (1991), Hata (1995) and us (2017). In my talk, I will briefly explain how transcendence measures can be proved, and also what were the crucial ingredients for the improvement.

Categorical measures for equivariant varieties

Daniel Bergh, *Copenhagen University*

Abstract: Given a variety endowed with an action by a finite group, we compare its equivariant categorical measure and the categorical measure of the extended quotient. Using weak factorization for orbifolds, we show that these two measures coincide in certain important cases. In particular, we use this to prove a conjecture by Galkin and Shinder regarding a relation between the categorical and the motivic zeta-functions. We also give examples showing that, in general, these two measures are not equal. This gives a counterexample to an early version of a conjecture by Polishchuk and Van den Bergh.

This is a joint work with S. Gorshinsky, M. Larsen and V. Lunts.