## Helson zeta-functions with prescribed zeros/poles in a half plane

Johan Andersson

A Helson zeta-function is a Dirichlet series with completely multiplicative unimodular coefficients. We prove that given any set of zeros and poles with multiplicities and without limit points in $\Re(s) < 1$, there exists a Helson zeta-function with exactly these zeros and poles with the given multiplicities. This improves on results of Seip and Bochkov-Romanov who proved the corresponding results in the strip $21/40 < \Re(s) < 1$ unconditionally and under the Riemann hypothesis in the strip $1/2 < Re(s) < 1$. We also show that a Helson zeta-function can have any connected open set $U$ that includes the half plane $\Re(s) > 1$ as maximal domain of analyticity. This improves on results of Bhowmik and Schlage-Puchta.

## The first and second moment for the length of the period of the continued fraction expansion for $\sqrt{d}$

Francesco Battistoni

Given a positive integer $d$ which is not a square, denote by $T(d)$ the length of the period of the continued fraction expansion for $\sqrt{d}$. We prove upper bounds for the first two moments of $T(d)$ by studying the moments of a different function $g(d)$, originally introduced by Hickerson: we detect the asymptotic of the first moment of $g(d)$ and an upper bound for the second moment. The results allow to improve the estimates for the size of the sets of integers d for which $(d) > \alpha\sqrt{d}$, with $\alpha$ a real parameter. We also report recent progress by Korolev on the asymptotic for the second moment of $g(d)$. This is a joint work with Loc Greni and Giuseppe Molteni.

## Points of bounded height on quintic del Pezzo surfaces over number fields

Christian Bernert

I will report on joint work with Ulrich Derenthal, where we establish Manin's conjecture for split smooth quintic del Pezzo surfaces over arbitrary number fields with respect to fairly general anticanonical height functions, using universal torsors. This is the first instance where Manin's conjecture is established over number fields different from $\mathbb{Q}$ for a non-toric smooth del Pezzo surface.

## The size of exponential sums near the origin

Julia Brandes

It is trivial to show that exponential sums are large near the origin. Since the resolution of the main conjecture associated with Vinogradov's mean value theorem, we now also have sharp bounds on the average size of exponential sums, taken over the entire unit torus. However, intermediate situations in which the average is taken only over suitable subsets of the unit torus are much less well understood. In the talk, I will present some results and conjectures regarding averages of exponential sums in the vicinity of the origin.

## A mean value theorem for general Dirichlet series

Frederik Broucke

We obtain a mean value theorem for a general Dirichlet series $f(s) = \sum_{j=1}^{\infty} a_j n_j^{-s}$ with positive coefficients for which the counting function $A(x) = \sum_{n_j \le x} a_j$ satisfies $A(x) = \rho x + O(x^{\beta})$ for some $\rho > 0$ and $\beta < 1$. We prove that $\frac{1}{T}\int_0^T |f(\sigma + it)|^2\, dt \to \sum_{j=1}^{\infty} a_j^2 n_j^{-2\sigma}$ for $\sigma > \frac{1+\beta}{2}$ and obtain an upper bound for $\beta < \sigma \le \frac{1+\beta}{2}$. We provide a number of examples indicating the sharpness of our results. If time permits, we also will discuss an application concerning the number of zeros of Beurling zeta functions. This talk is based on joint work with Titus Hilberdink (Nanjing University)

## Expander estimates for cubes

Jörg Brüdern

Suppose a set of natural numbers $A$ of positive exponential density is given. What can we say about the exponential density of

$B = \{a + x^3 : a \in A, x, \in \mathbb{N}\}$? Davenport (1942) still holds the world record in this area. We describe joint work with Simon Myerson that improve on Davenport's work considerably when the exponential density of $A$ exceeds 3/5.

## On the density hypothesis for $L$-functions associated with holomorphic forms

Gregory Debruyne

The density hypothesis states that $N(\sigma, T)$, the number of zeros of an $L$-function in the region $\Re s \ge \sigma, |\Im s| \le T$ satisfies $N(\sigma, T) \ll_{\varepsilon} T^{2(1-\sigma)+\varepsilon}$, for $1/2 < \sigma < 1$ as $T \to \infty$ for each $\varepsilon > 0$. The validity of the density hypothesis for different types of $L$-functions is intimately connected to arithmetic applications. For the zeta function, for example, the validity of the density hypothesis would have strong implications on the number of primes in short intervals. We will discuss some recent improvements on the range of validity of the density hypothesis for $L$-functions associated with holomorphic forms. The talk is based on collaborative work with Bin Chen and Jasson Vindas.

## Two dimensional arithmetic progressions avoiding squares

Rainer Dietmann

Croot, Lyall and Rice, as a model case of a more general result, have shown that any proper symmetric two-dimensional arithmetic progression taking values in $[-T, T]$ and not containing any non-zero perfect square, can have at most $O(T^{5/6+\varepsilon})$ many elements. I want to report on joint work with Christian Elsholtz which reduces the exponent to 20/27. Our approach uses a more elementary argument inspired by work of Zaharescu which in this situation performs better than the more general framework applied by Croat, Lyall and Rice.

### Zeros of the $\zeta$-function near 1 and The Large Sieve

Thomas Dubbe

We know, that there is no non-trivial zero $\rho = \beta + i\gamma$ of the Riemann $\zeta-$function with real part $\beta \geq 1 - \frac{r}{\log \gamma}$. The best known value for this (de la Valéé Poussin-type) zero-free region is due to Mossinghoff, Trudgian and Yang with $r \approx 0.1798$. Of course, one can ask how many zeros might appear between the heights $T$ and $T + H$ if we increase $r$ and thus moving the line $1 - \frac{r}{\log t}$ slightly to the left. In this talk we will explore how the Large Sieve is connected to this problem and how it can be used to derive explicit upper bounds for the number of such zeros.

### Improving Behrend's construction on integers without arithmetic progression

Christian Elsholtz

In this talk we review what is known on the size of sets in $\{1, ..., N\}$ without arithmetic progressions. Upper bounds are due to Roth, Szemeredi, Gowers, Green-Tao, Sanders, Bloom-Sisask, and quite recently Kelley-Meka. For progressions of size 3 (which is the most frequently studied case) lower bounds are due to Szekeres, Salem-Spencer (1942), Behrend (1946), and Elkin (2011). We report on a recent improvement of the lower bound, based on finding suitable two dimensional sets. These sets are key for constructing the first 3-progression-free sets in$(\mathbb{Z}_m)^n$ (i.e. in very high dimension) of size $(cm)^n$, with a constant $c > 1/2$. And these sets eventually are embedded into the integers to give large progression-free sets in $\{1, ..., N\}$.

This is joint work with Zach Hunter, Laura Proske, and Lisa Sauermann.

### Avoiding long progressions in $\mathbb{F}_p^n$

Jakob Führer

We study subsets of $\mathbb{F}_p^n$ that do not contain arithmetic progressions of length $k$. We denote by $r_k(\mathbb{F}_p^n)$ the cardinality of such subsets containing a maximal number of elements and consider its asymptotic behaviour as $n$ tends to infinity. The case $k = 3$ is well studied and most techniques used generalize to other constant $k$. We will, however, consider $k$ that increase with $p$.

The main focus of this talk will be on lower bounds for $r_p(\mathbb{F}_p^n)$ . We will present a construction that gives an improvement to previously known bounds for every $p \geq 5$, and also gives the first lower bounds $c^n$ for $r_p(\mathbb{F}_p^n)$ with $c = p - o(1)$, as also $p$ tends to infinity.

### A lower bound for the number of primitive elements on lines in finite field extensions

Bahadir Gizlici

Let $\theta$ be a generator of the finite field extension $\mathbb{F}_{q^n}/\mathbb{F}_q$ and $\alpha \in \mathbb{F}_{q^n}^*$. Given an integer $n \geq 2$, for which prime power $q$ does every line $\mathcal{L} := \{\alpha(\theta + x) : x \in \mathbb{F}_q\}$ of the finite field extension $\mathbb{F}_{q^n}/\mathbb{F}_q$ contain a primitive element? We will answer this question in this talk and our method uses Selberg's $\Lambda^2\Lambda^-$ method. This improves the recent result of Cohen and Kapetanakis.

## Explaining the beauty in the factorization of $X^{na}$ over a finite field

Anna-Maurin Graner

The polynomial $X^{n1}$, its famous factor, the $n$-th cyclotomic polynomial, and their factorizations over a finite field $\mathbb{F}_q$ have been studied for a long time. Among the first to study the factorization of n over finite fields was Carl Friedrich Gauss in 1876 and the polynomial has fascinated many mathemati- cians since then. We study the factorization of the polynomial $X^n a$ for arbitrary $a \in \mathbb{F}_q$. This factorization has a beautiful underlying structure which is closely connected to the order of the element $a$ in the multiplicative group $\mathbb{F}_q$ . Using these observations we are able to give a closed explicit formula for the factorization of $X^{na}$ into monic irreducible factors over a finite field for all $a \in \mathbb{F}_q$ and for every positive integer $n$. From our formula we can derive the explicit factorization of both $X^{n1}$ and the $n$-th cyclotomic polynomial over a finite field for every positive integer $n$.

## Combinatorics and Diophantine equations

Katalin Gyarmati

In this talk, we apply combinatorics to study problems related to Diophantine-type equations. In the first part, we study the cardinality of such sets of squares in which the difference between any two squares is also a square. Such a set with $m$ elements is called a Diophantine square $m$-tuple. For example, we will see that there are infinitely many Diophantine square triples. It is also proved that there is no Diophantine square triple that only contains squares of Fibonacci numbers. The second part of the talk is a joint work with my colleague Katalin Fried. We say that a set $\mathcal{B} \subseteq \mathbb{Z}$ forms a multiplicative basis of order $h$ of $\mathcal{S}$ if every element of $\mathcal{S}$ can be written as the product of $h$ members of $\mathcal{B}$. We give non-trivial lower bounds for the size of multiplicative basis of order 2 of the set $\{f(1), f(2), \ldots, f(n)\}$ where $f(x) \in \mathbb{Z}[x]$ is a polynomial. We also study generalizations of these problems.

## Quasi-periodic and palindromic continued fractions in $\mathbb{Q}_p$

Nadir Murru

The topic of studying transcendental numbers via continued fractions is well studied since many years. A first result in this sense is essentially due to Liouville, who used continued fractions with unbounded partial quotients. Then Maillet and Baker studied quasi-periodic continued fractions with bounded partial quotients proving, under some conditions, convergence to transcendental numbers. These results have been then improved by several authors (e.g, by Adamczewski and Bugeaud), dealing with several different kind of continued fractions. In this talk, we present a brief overview about these results and then we show analogue results for continued fractions in the field of p-adic numbers. Firstly, we focus on the heights of some $p$-adic numbers having a periodic expansion obtaining some upper bounds. Thanks to these results, together with $p$-adic Roth-like theorem and the Subspace theorem, we prove the transcendence of some families of $p$-adic continued fractions. In particular, we study some quasi-periodic continued fractions and continued fractions beginning with arbitrarily long palindromes. This is a joint work with Ignazio Longhi and Francesco Saettone.

## Precision Asymptotics for Partitions Featuring False-Indefinite Theta Functions

Caner Nazaroglu

A large class of problems in additive number theory have easier and more precise resolutions once one can relate the corresponding generating functions to modular forms. Many of these stronger asymptotic results extend to problems where the generating function is not quite modular, but its obstruction to being modular is controlled by other modular or "modular adjacent" objects. Examples include (mixed) false or mock modular objects, as well as higher depth variants. In joint work with K. Bringmann and W. Craig we develop the machinery to extend these results to contexts involving a class of false-indefinite theta functions that are related to Maass forms. Our results enable the derivation of quite precise asymptotic expansions or, under the right conditions, HardyRamanujanRademacher style exact formulas. We give our analysis for a concrete example involving partitions with parts separated by parity and derive an asymptotic expansion that includes all the exponentially growing terms.

## On Vu's theorem in Waring's problem

Javier Pliego Garcia

Answering a question of Nathanson about thin basis, Vu showed in 2000 the existence for $k > 1$ and some $s = s(k)$ of subsequences $X_k$ satisfying that for every sufficiently large natural number $n$ then the number of solutions of $n = x_1^k + ... + x_s^k$ with $x_i \in X_k$, which we denote by $R_s(X_k, n)$, satisfies the relation $R_s(X_k, n) \approx log(n)$. Soon after the previous paper was published, Wooley (2003) improved the constraint on the number of variables. In this talk we shall discuss new results concerning problems within this circle of ideas.

## Distribution of Smooth Numbers in Short Intervals

Sarvagya Jain

A positive integer is considered $y$-smooth if all its prime factors are less than or equal to $y$. There are several works in the literature about the distribution of $y$-smooth numbers in intervals of the form$[x, x + h]$, where $h$ is significantly smaller than $x$. Notably, Matomäki and Radziwiłłproved that when $y$ is a fixed power of $x$, almost all intervals $[x, x+h]$ contains the expected proportion of $y$-smooth numbers, provided $h$ tends to infinity with $x$. In this talk, I will focus on the ideas behind understanding the distribution of $y$-smooth numbers in short intervals, especially for smaller values of $y$.

## The theory and applications of twists of $L$-functions

Jerzy Kaczorowski

The talk will focus on twists of $L$ functions from the extended Selberg class and rely on joint works with Alberto Perelli. After presenting a relatively complete theory of the standard non-linear twist, we shall discuss a general transformation formula for twists with leading exponent $> 1/d$. Finally, we pass to the description of the group's action of

$$\mathfrak{S} = \langle T, S^{(k)}, k \in \mathbb{N}; T^2 = E, S^{(k)}S^{(l)} = S^{(l)}S^{(k)} \rangle$$

on $L$-functions and describe selected applications, such as description of the structure of $S^\sharp$ in lower degrees, forms of admissible local Euler factors for $L$-functions of degree 2, self-reciprocal twists and Lindelöf Hypothesis.

## $m$-to-1 mappings on finite fields
Gohar Kyureghyan

For $m \geq 1$, a mapping of the finite field $\mathbb{F}_q$ is called m-to-1 if every element in its image set has exactly $m$ preimages. Such mappings appear in many applications of finite fields. The case $m = 1$, that is the case of bijective mappings, is a well studied classical problem in research on finite fields. There are only few known results for $m \geq 2$.

In this talk we give a short survey on the problem and its applications in cryptology and finite geometry. We show that on the binary finite fields the classification of 2-to-1 binomials is equivalent to the classification of o-monomials, which is a well-studied and elusive problem in finite geometry.

## Distrimution of smooth polynomials
László Mérai

In 2015, Bourgain investigated the distribution of primes with a positive proportion of preassigned bits. His method has been adapted in different settings, for example Ha (2016) considered this question in the case of rational function fields over finite fields by studying the distribution of irreducible polynomials with preassigned coefficients.In this talk, we explore this question for friable (or smooth) polynomials. We recall that a polynomial is $m$-friable if all of its irreducible factors are of degree at most $m$. Among others, we show that under some natural conditions, the number of $m$-friable polynomials of degree $n$ with $r$ preassigned coefficients over the finite field of size $q$ tends to

$$\rho(n/m)q^{n-r},$$

where $\rho$ is the Dickman's $\rho$ function.

## Zero density theorem for general analytic functions
János Pintz

We present a general zero density theorem which can be applied to a relatively large class of analytic functions but it yields some improvements in case of Riemann's zeta function as well, if we are near to the boundary line Re s=1. It also improves earlier results for the density of zeros of Dedekind zeta functions and Beurling zeta functions.

## There is no 290-Theorem for higher degree forms
Om Prakash

A universal quadratic form is a positive definite quadratic form with integral coefficients which represents all positive integers – a classical example being the sum of four squares $x^2 + y^2 + z^2 + w^2$. The 290-Theorem of Bhargava and Hanke characterizes positive definite quadratic forms over rational integers that are universal as exactly the forms that represent $1, 2, 3, \ldots, 290$. In this talk, I will discuss universality of higher degree forms (i.e. homogeneous polynomials of degree $m > 2$)

and I will prove that no statement like the 290-Theorem can hold for them. If time permits, I will conclude with the more general case of forms over totally real number fields. This is a joint work with Vitezslav Kala.

### Arithmetical Fourier Polynomials: An Urchin Story

Olivier Ramaré

The Fourier Polynomial $T(\alpha) = \sum_{p \le N} e(p\alpha)$ carry information that is sometimes more accessible and maybe distinct from the distribution in arithmetic progressions or in short intervals. In an effort to understand those, we shall present numerical and theoretical results on the modulus of

$$T^*(\alpha) = \sum_{\substack{p \le N \\ p \in \mathcal{P}^*}} e(p\alpha),$$

where $\mathcal{P}^*$ is a subset of the primes of positive relative density. We show in particular that the number of large values of $T^*$ is comparable to the one of $T$, hinting at a possible additive structure. After a detour towards maybe very small values, we extend our study to the set of Gaussian integers rather than the set of primes, with similar results.

If time permits, we will conclude with a primes' analogue of the Chang Inequality that implies that the large values set indeed displays some additive structure when the relative density of the set goes to 0.

### On the digits of primes and squares

Joël Rivat

The difficulty of the transition from the digital representation of an integer to its multiplicative representation (as a product of prime factors) is at the source of many important open problems in mathematics and computer science. In the last 20 years, in collaboration with Christian Mauduit, we solved the questions of Gelfond (1968) for primes and squares, and obtained several generalisations. We continued this work in collaboration with Michael Drmota, showing in particular the well distribution of primes in two bases, and the normality of the Thue-Morse sequence along the squares. We plan to present a selection of results and methods on this subject, which has attracted the interest of many authors, including Bourgain and Maynard.

### Lower bounds for the number of zeroes of cubic forms

Nick Rome

Given a cubic form with integer coefficients in n variables, in joint work with V. Kumaraswamy, we show that for large enough n the number of zeroes in a box of sidelength $B$ grows at least as quickly as $B^{n-9}$. In particular, we make no assumptions about the singularities of the form. This resolves a conjecture of Wooley for forms of large enough dimension.

## Nonvanishing of $L$-functions and Poincare series for Jacobi forms

Brundaban Sahu

Y. Martin introduced a set of kernel functions for the Jacobi groupto study $2m$ Dirichlet series associated with a Jacobi form of weight $k$ and index $m$. We study nonvanishing of these kernel functions and also study nonvanishing of $2m$ Dirichlet series associated with Jacobi form of weight $k$ and index $m$. We also discuss analogous generalizations to Jacobi forms of matrix index.

## Generalised quadratic forms over totally real number fields

Damaris Schindler

We introduce a new class of generalised quadratic forms over totally real number fields, which is rich enough to capture the arithmetic of arbitrary systems of quadrics over the rational numbers. We explore this connection through a version of the Hardy-Littlewood circle method over number fields. This is joint work with Tim Browning and Lillian Pierce.

## Rational transformations that are never irreducible

Max Schulz

Rational transformations play an important role in the construction of irreducible polynomials over finite fields. Usually, the methods involve fixing a rational function $Q \in \mathbb{F}_q(x)$ and deriving conditions on polynomials $F \in \mathbb{F}_q[x]$ such that the rational transformation of $\mathbb{F}$ with $Q$ is irreducible. In this talk we want to change the perspective and look at rational functions with which the rational transformation never yields irreducible polynomials.

## On Classification of Sequences Containing Arbitrarily Long Arithmetic Progressions

Doga Can Sertbas

The length of the longest arithmetic progression in certain subsets of positive integers has been extensively studied in mathematics. For instance, Szemerdi proved that any subset of positive integers with positive upper density contains arbitrarily long arithmetic progressions. The same property also holds for the prime numbers, and it was proved by Green and Tao. On the other hand, the theorem of Darmon and Merel implies that the set of $k$-th powers of positive integers does not contain any arithmetic progression of length three, when $k \geq 3$. In this talk, we deal with the subsets of positive real numbers whose elements satisfy certain growth conditions. In particular, we first mention how the polynomial map $n^k$ can be extended so that its image contains arbitrarily long arithmetic progressions. Besides, we provide a uniform and explicit bound for the length of the longest arithmetic progression in a large class of sequences of exponential growth. As a result, we give necessary and sufficient conditions for certain sets of sequences for which the length of the longest arithmetic progression in it is bounded by this uniform bound. This is a joint work with Şermin Çam Çelik, Sadık Eyidoğan and Haydar Göral.

## Reversible primes

Cathy Swaenepoel

The properties of the digits of prime numbers and various other sequences of integers have attracted great interest in recent years. For any positive integer $k$, we denote by $\overleftarrow{k}$ the *reverse* of $k$ in base 2, defined by

$$\overleftarrow{k} = \sum_{j=0}^{n-1} \varepsilon_j \, 2^{n-1-j} \quad \text{where} \quad k = \sum_{j=0}^{n-1} \varepsilon_j \, 2^j$$

with $\varepsilon_j \in \{0,1\}$, $j \in \{0, \ldots, n-1\}$, $\varepsilon_{n-1} = 1$. A natural question is to estimate the number of primes $p \in \left[2^{n-1}, 2^n\right)$ such that $\overleftarrow{p}$ is prime. We will present a result which provides an upper bound of the expected order of magnitude. Our method is based on a sieve argument and also allows us to obtain a strong lower bound for the number of integers $k$ such that $k$ and $\overleftarrow{k}$ have at most 8 prime factors (counted with multiplicity). We will also present an asymptotic formula for the number of integers $k \in \left[2^{n-1}, 2^n\right)$ such that $k$ and $\overleftarrow{k}$ are squarefree.

This is a joint work with Cécile Dartyge, Bruno Martin, Joël Rivat and Igor Shparlinski.

## Cilleruelo's conjecture on the LCM of polynomial sequences

Marc Technau

We discuss a conjecture of Cilleruelo on the growth of the least common multiple of consecutive values of a polynomial and subsequent progress towards it in work of Rudnick–Maynard and Sah. In recent work, the speaker and, independently, Alexei Entin made further advances by exploiting symmetries amongst the roots of the polynomials in question. We shall discuss these approaches and related beautiful work of Baier and Dey.

## Deterministic Randomness: lacunary and sub-lacunary sequences

Robert Tichy

We study lacunary and polynomial sequences with respect to various measures of pseudorandomness. This includes a comparison of the classical discrepancy with variants of the correlation measure in the sense of Mauduit and Sarkoezy and others. In particular, we present results for the distribution behaviour of lacunary sequences and for sequences of "almost exponential" growth, such as the so-called Hardy-Littlewood-Polya sequence and sequences satisfying an Erdős gap condition. Furthermore, some results are extended to the general frame of Hardy fields. Connections to arithmetical dynamical systems are addressed. Several results are contained in a survey article by Aistleitner, Berkes and Tichy appearing soon in volume 62 of the SMF series Panoramas et Synthèses and in recent joint work with M. Madritsch.

## Non-decomposable quadratic forms over totally real fields

Magdaléna Tinková

Non-decomposable quadratic forms with integer coefficients were studied, for example, by Mordell (1930, 1937) and Erds and Ko (1938). However, we know much less about them if their coefficients belong to the ring of algebraic integers of a totally real number field. Some of our new results are general, but one part is restricted to the case of binary quadratic forms over real quadratic fields. For them, we provide some bounds on the number of such non-decomposable quadratic forms, show that their number is rather large for almost all quadratic fields, or give their whole structure for several examples of these fields. We also show a relation between them and the problem of $r$-universal quadratic forms. This is joint work with Pavlo Yatsyna.

## Primes in arithmetic progressions on average

Parry Tomos

Let $E_x(q, a)$ be the error term when counting primes in AP's. We show that on average for $q$ close to $x$ in the usual BDH sense there is further cancellation than the root$(x/q)$ heuristic. Previously this was known only on (quite heavy) conjectures.

## Distribution of modular symbols

Svenja zur Verth

Modular symbols are a special case of additive twists of modular $L$-functions. We are working towards the conjectured normal distribution of their values of Mazur and Rubin. A better understanding of their distribution would allow conclusions on the moments of $L$-functions. While explicit computations of the first and second moments of $L$-functions were achieved, it seems hard to obtain their higher moments. Currently for higher moments there are resuts on average. Contrary to that we want to put arithmetic constraints on the averaging sum, like for example summing over squarefree, almost prime or prime numbers.

## Local divisor correlations in almost all short intervals

Mengdi Wang

The celebrated Matomaki-Radziwill theorem has driven many important advancements in analytic number theory: for instance, the averaged Chowla conjecture; the divisor correlations in almost all short intervals; and the local Fourier uniformity of the Liouville function. In this talk, we will explain how to apply the Matomaki-Radziwill theorem and the circle method to understand the averaged divisor correlations in almost all short intervals, where we assume that the divisor functions are supported on very short intervals and the shifting factor also varies in a very short interval. This talk is based on joint work with Javier Pliego and Yu-Chen Sun.

## Lattice Points in Thin Sectors

Ezra Waxman

On the circle of radius $R$ centred at the origin, consider a "thin" sector about the fixed line $y = \alpha x$ with edges given by the lines $y = (\alpha \pm \epsilon)x$, where $\epsilon = \epsilon_R \to 0$ as $R \to \infty$. We discuss an asymptotic count for $S_\alpha(\epsilon, R)$, the number of integer lattice points lying in such a sector, and moreover present results concerning the variance of such lattice points across sectors.

## Freiman's $3k-4$ Theorem in a Function Field setting

Mieke Wessel

By a conjecture of Bachoc, Couvreur and Zemor we can generalize Freiman's 3k-4 Theorem to a function field setting. In this talk I will explain why its natural to go from finite sets and arithmetic progressions to finite dimensional vector spaces and Rieman Roch spaces by giving many examples.

## Integral points on affine cubic surfaces: heuristics and numerics

Florian Wilsch

We develop a heuristic for the number of integral solutions to cubic equations in three variables based on the circle method, predicting a logarithmic order of magnitude. This generalizes Heath-Browns conjecture on the number of representations k = x + y + z of an integer k (that is not a perfect cube) as a sum of three cubes. We test this heuristic against asymptotic formulae by Zagier on the Markoff surface and by Baragar and Umeda on variants of it. Moreover, we obtain numerical data on some families of surfaces to test our heuristic against.

This is joint work with Tim Browning.

## Randomness of sequences modulo one

Nadav Yesha

How to detect (pseudo-)randomness of a sequence modulo one? In this talk we will try to answer this question by studying statistics for the number of points in random short intervals. We will consider both the "local" regime, which has been extensively studied in the last couple of decades, and the "intermediate" regime which attracted less attention. In particular, we will discuss some recent and new results for several important examples in the intermediate regime, including joint work (in progress) with C. Aistleitner.

## On Correlations of Liouville-like functions

Yichen You

Let A be a set of mutually coprime positive integers, satisfying $\sum_{a\in A}\frac{1}{a}=\infty$. Define the (possibly non-multiplicative) "Liouville-like" functions $\lambda_A(n)=(-1)^{|\{a:a|n,a\in A\}|}$ or $(-1)^{|\{a:a^\nu\|n,a\in A,\nu\in\mathbb{N}\}|}$. We show that $\lim x\to\infty\frac{1}{x}\sum_{n\leq x}\lambda_A(n)=0$ holds, answering a question of de la Rue. We also show that if $A\cap\mathbb{P}$ has relative density 0 in $\mathbb{P}$, the $k$-point correlations of $\lambda_A satisfies \lim_{x\to\infty}\frac{1}{x}\sum_{n\leq x}\lambda_A(a_1n+h_1)\cdots\lambda_A(a_kn+h_k)=0$, where $k\geq 2, a_ih_j\neq a_jh_i$ for all $1\leq i<j\leq k$, extending a recent result of O. Klurman, A. P. Mangerel, and J. Teräväinen.

## Hurwitz class numbers, CM modular forms, and primes of the form $x^2+ny^2$

Mikulas Zindulka

Modular forms found many applications in the study of arithmetic functions. Given an arithmetic function $f$, one may hope that the values $f(n)$ are coefficients of a modular form. This often leads to the proof of some remarkable relations satisfied by these values. The example relevant for this talk is $f(n)=H(n)$, where $H(n)$ is the *n-th Hurwitz class number.* It turns out that the generating function for the numbers $H(n)$ is a weight $3/2$ mock modular form. In other words, it can be completed, by adding a suitable non-holomorphic piece, to a harmonic Maass form. In this talk, we consider sums of Hurwitz class numbers of the type $\sum_{t\equiv m \pmod{M}} H(p-t^2)$, where $p$ is a prime. Such sums were previously considered mostly for $M$ prime. We show that for $M = 6$ and $8$, these sums can be expressed in terms of coefficients of CM cusp forms. This leads to explicit formulas depending on the expression of $p$ in the form $p = x^2 + ny^2$.