Timetable

IS: Invited Speaker (45min), CT: Contributed Talk (15min),

Monday, 28 of March

8:30–9:20	**Registration**		
9:20–9:30	**Welcome remarks**		
9:30–10:30	IS	**Asbjørn Nordentoft** Paris 13	On the distribution of closed geodesics on modular curves
10:30–11:30	IS	**Giulia Cesana** Köln	Asymptotic equidistribution for partition statistics and topological invariants
11:30–13:00	**Lunch**		
13:00–14:00	IS	**Robin Frot** Renyi	Non-vanishing of L-functions at the central value
14:00-15:00	IS	**Raphael Steiner** ETH	Fourth moments of automorphic forms
15:00–15:40	**Coffee + Cake**		
15:40–16:00	CT	**Alessandro Lägeler** ETH	Cycle Integrals of the Parson Poincaré Series
16:00–16:20	CT	**Tim Davis** Queen Mary	Fourier coefficients of Hilbert modular forms at cusps
16:20–16:40	CT	**Ilaria Viglino** ETH	Splitting properties of certain families of S_n-polynomials and applications to class group torsion
16:40–17:00	CT	**Svenja zur Verth** EPFL	Distribution of modular symbols
17:00-17:20	CT	**Andreas Mono** Köln	Constructions of various Maaß forms via quadratic forms
18:30	**Conference Dinner**		

Tuesday, 29 of March

8:45-9:00	**Entry**		
9:00-9:50	IS	**Priyanka Majumder** Darmstadt	Bounds for canonical Green's functions of Fuchsian groups
9:50–10:20	**Coffee**		
10:20-10:40	CT	**James Branch** Nottingham	A survey on half integral weight modular forms
10:40-11:40	IS	**Sonja Žunar** Zagreb	Non-vanishing of Poincaré series
11:40–12:00	CT	**Joshua Drewitt** Nottingham	An introduction to the space of real-analytic modular forms
12:00-12:20	CT	**Frederik Broucke** Ghent	Pointwise analysis of Riemann's other function
12:20–12:40	CT	**Vignesh Arumugam Nadarajan** EPFL	Non-correlation between Fourier coefficients of automorphic forms and trace functions
12:40–14:00	**Lunch**		
14:00–15:00	IS	**Félicien Comtat** Queen Mary	The Kuznetsov formula for $GSp(4)$
15:00–15:20	CT	**Dávid Tóth** Renyi	On a generalization of the Selberg trace formula
15:20–15:40	CT	**Antareep Mandal** Berlin	Uniform sup-norm bounds for Siegel cusp forms
15:40–16:00	CT	**Benjamin Brindle** Köln	Proving SZ-duality with connected sums

List of Abstracts

Monday 28th

On the distribution of closed geodesics on modular curves

Asbjørn Nordentoft IS

Paris 13, France

The study of closed geodesics on Riemann surfaces is a classical topic. In the arithmetic case (i.e. modular curves) the closed geodesics can be parametrized by split quadratic forms and as such has an associated discriminant. We will explain a celebrated result of Duke which shows that as the discriminant goes to infinity, the geodesics equidistribute. Secondly we will consider the distribution of closed geodesics in the homology of the modular curves. Finally we will explain the proofs and the connections to L-functions.

Asymptotic equidistribution for partition statistics and topological invariants

Giulia Cesana IS

Köln, Germany

Throughout mathematics, the equidistribution properties of certain objects are a central theme studied by many authors. In my talk I am going to speak about a joint project with William Craig and Joshua Males, where we provide a general framework for proving asymptotic equidistribution, convexity, and log-concavity of coefficients of generating functions on arithmetic progressions.

Non-vanishing of L-functions at the central value

Robin Frot IS

Renyi, Hungary

In this presentation, we will give an overview of the general ideas behind the non-vanishing of automorphic L-functions. After giving a background for the Maass forms for GL(n), we will explain a recent non-vanishing result for the products of a twisted GL(3) Hecke–Maass L-function and a Dirichlet L-function.

Fourth moments of automorphic forms

Raphael Steiner IS

ETH, Switzerland

By looking at a toy example concerning holomorphic forms in the mixed weight/level aspect, we explain how and when it may be feasible to express geometrically and bound a fourth moment of automorphic forms. Subsequently, we clarify how the argument can be made rigorous and put into a robust framework using either the theta correspondence or Voronoi summation for Rankin-Selberg convolutions. This is joint work with Ilya Khayutin and Paul Nelson.

Cycle Integrals of the Parson Poincaré Series

Alessandro Lägeler CT

ETH, Switzerland

We present a geometric formula for the cycle integrals of Parson's modular integrals in terms of the intersection angles of geodesics on the modular curves. This is an analog for modular integrals of a classical formula for cycle integrals of hyperbolic Poincaré series, due to Katok. On the other hand, it extends a recent geometric formula of Matsusaka and Duke, Imamoglu, and Toth for the cycle integrals of weight 2 modular integrals.

Fourier coefficients of Hilbert modular forms at cusps

Tim Davis CT

Queen Mary, UK

In this talk we give an answer to the following question: given a Hilbert newform and a matrix in the Hilbert modular group what is the explicit number field which contains all the Fourier coefficients of the Hilbert newform at that cusp? This generalises a result by Brunault and Neururer who answered this question in the setting of classical newforms. We will give an overview of the method used to prove our result which differs from the method of Brunault and Neuruer and relies on the properties of local Whittaker newforms.

Splitting properties of certain families of S_n-polynomials and applications to class group torsion

Ilaria Viglino **CT**

ETH, Switzerland

It is known that with high probability a random degree n monic polynomial with integer coefficients and height less or equal than N, is irreducible with splitting field over $\mathbb{Q}$ with Galois group S_N. We are interested in an explicit version of the Chebotarev density theorem on average for our family (and also for subfamilies) of S_n-polynomials, without assuming GRH for the Dedekind zeta-function or the Artin conjecture, because of the average properties of the family. By the work of Ellenberg and Venkatesh, the existence of many primes that split completely in a finite Galois extension, contributes significantly to the quotient of the class group by its l-torsion, yielding interesting upper bounds which improve the trivial bound by the order of the entire class group. It represents an evidence towards the so-called "ϵ-conjecture", suggested by Duke for CM fields and a stronger form by Brumer and Silverman.

Distribution of modular symbols

Svenja zur Verth **CT**

EPFL, Switzerland

This talk introduces modular symbols and conjectures formulated by Mazur, Rubin and Stein about the value distribution of them. Modular symbols are important in the study of the order of vanishing of L-function. This might relate to the rank of elliptic curves by the Birch and Swinnerton-Dyer conjecture. We will explain the motivation behind the conjectures of Mazur, Rubin and Stein and how and why the study of modular symbols is interesting.

Constructions of various Maaß forms via quadratic forms

Andreas Mono **CT**

Köln, Germany

We present a construction of elliptic, parabolic, and hyperbolic Eisenstein series utilizing the averaging technique over a set of integral binary quadratic forms of some fixed discriminant $D \in \mathbb{Z}$. This leads to ordinary, polar, and locally harmonic Maaßforms depending on the sign of D.

Tuesday 29th

Bounds for canonical Green's functions of Fuchsian groups

Priyanka Majumder IS

Darmstadt, Germany

Let Γ be a cofinite Fuchsian subgroup of $PSL(2,\mathbb{R})$ and $\mathbb{H}$ be the upper half-plane. Then the quotient space $X = \Gamma\backslash\mathbb{H}$ is conformally equivalent to a non-compact Riemann surface. Let μ be a smooth metric on X and with respect to μ, we can define Green's function on X. In my talk, I will explain two different techniques for bounding the canonical Green's function with respect to the canonical metric on X. Then by considering some explicit examples of cofinite Fuchsian subgroups namely the congruence subgroups of $PSL(2,\mathbb{Z})$, we derive asymptotics for the canonical Green's function at cusps.

A survey on half integral weight modular forms

James Branch CT

Nottingham, UK

In this talk I will give a classical historical survey account of the theory of half integral weight modular forms. Roughly I'll break the talk into three theorems: those by Shimura, Tunnell and Waldspurger and give sketches of their proofs. If there is time, I'll also talk about the newform theory in this setting.

Non-vanishing of Poincaré series

Sonja Žunar IS

Zagreb, Croatia

The question when a cusp form defined by a Poincaré series vanishes identically was recognized as interesting and complicated as early as 1882 by H. Poincaré. Most existing approaches to this problem are based on estimating Fourier coefficients of cusp forms in question. In 2009, G. Muić proved an integral non-vanishing criterion for Poincaré series on locally compact Hausdorff groups and used it to study the non-vanishing of various cusp forms of integral weight. In this talk, we present a strengthening of Muić's criterion and discuss its applications to different types of cusp forms, such as cusp forms of half-integral weight and cuspidal vector-valued modular forms.

An introduction to the space of real-analytic modular forms

Joshua Drewitt **CT**

Nottingham, UK

The space of real-analytic modular forms was recently introduced by Francis Brown. One reason why this space is of great interest is because it contains or intersects various previously studied classes of important modular objects, such as classical modular forms, weakly anti-holomorphic forms and Maass wave forms. The purpose of this talk is to introduce you to this space and to demonstrate just a few of its many interesting properties. We give examples of real-analytic modular forms, discuss the period polynomials and L-functions related to this space, and look at certain subspaces of particular interest.

Pointwise analysis of Riemann's other function

Frederik Broucke **CT**

Ghent, Belgium

We consider the function f defined as

$$f(x) = \sum_{n=1}^{\infty} \frac{\sin(\pi n^2 x)}{n^2},$$

which would have been proposed by Riemann as a continuous but nowhere differentiable function. The pointwise analysis of this function has a rich history, culminating in the work of Duistermaat en Jaffard, who determined the pointwise Hölder exponent of f at every point. In this talk, we will present a direct and elementary method to obtain the pointwise regularity results. This talk is based on collaborative work with Jasson Vindas.

Non-correlation between Fourier coefficients of automorphic forms and trace functions

Vignesh Arumugam Nadarajan **CT**

EPFL, Switzerland

Let p be a prime. Let $K : \mathbb{Z}/p\mathbb{Z} \to \mathbb{C}$ be a function which we will lift to $\mathbb{Z}$. Let $\{\rho_f(n)\}_{n\geq 1}$ be the Fourier coefficients of a Hecke eigenform (which we will assume to be normalized to have bounded absolute value.) We would like to consider the smoothed version

$$S_V(f, K, p) = \sum_{n\geq 1} \rho_f(n)K(n)V(n/p)$$

where $V(\cdot)$ is a smooth compactly supported function supported on $[0, 1]$. The trivial bound for such a sum is

$$S_V(f, K, p) \ll_{V,f} \max(K)p.$$

Fouvry, Kowalski and Michel showed that one can do much better for a special calss of functions called *trace functions*. They proved for K a isotypic trace function

$$S_V(f, K, p) \ll p^{1-\delta}$$

for any $\delta < 1/8$ with implied constant depending only on V, f, δ and conductor of K. In this talk, we will consider a generalisation of the above question to GL_2-automorphic forms over a number field F. Let $\mathfrak{p}$ be a prime ideal. If ϕ is a cusp form of level coprime to $\mathfrak{p}$, we will present non-trivial bounds for

$$\sum_{m\in F^\times} K(m_\mathfrak{p})W_\phi\left(\begin{pmatrix} m\pi_\mathfrak{p} & 0 \\ 0 & 1 \end{pmatrix}\right)$$

where W_ϕ is the global Whittaker function of ϕ. If time permits we will discuss also the strategy of the proof.

The Kuznetsov formula for $GSp(4)$

Félicien Comtat **IS**

Queen Mary, UK

In this talk, I will present my work on the Kuznetsov formula for $GSp(4)$. The latter relates Whittaker coefficients of Maass forms on $GSp(4)$ for a certain congruence subgroup to sums of generalised Kloosterman sums. In the first part of the talk, I will give an overview of how the Kuznetsov formula for $GSp(4)$ can be proved by integrating a trace formula against a character of the unipotent subgroup. I will then present an application to equidistribution of Satake parameters of $GSp(4)$ Maass forms with respect to the Sato-Tate measure as the level tends to infinity, providing some evidence towards the Generalised Ramanujan Conjecture in this setting.

On a generalization of the Selberg trace formula

Dávid Tóth **CT**

Renyi, Hungary

We give a generalized version of the Selberg trace formula introduced and proved originally for finite volume Fuchsian groups by András Biro in 1999. Biro used a weighted automorphic kernel function, where the weight function was an automorphic form, and calculated the integral of their product over the fundamental domain of the Fuchsian group in two different ways, geometrically and spectrally - as in the case of the original trace formula. Together with Biro we recently worked out the generalized formula in full detail for Hilbert modular groups belonging to totally real quadratic fields of class number one, that are well-known discrete subgroups of $PSL(2, R)^2$ acting on the product of two upper half-planes. Also, some parts of this work has been accomplished for more general discrete subgroups of $PSL(2, R)^n$, and these partial results are also discussed shortly.

Uniform sup-norm bounds for Siegel cusp forms

Antareep Mandal **CT**

Berlin, Germany

This talk is about obtaining uniform sup-norm bounds of Siegel cusp forms on average over an orthonormal basis. We relate this quantity to the eigenspace for the smallest eigenvalue of the respective weighted Maass-Laplacian and then analyze the corresponding heat kernel to arrive at the desired bounds.

Proving SZ-duality with connected sums

Benjamin Brindle **CT**

Köln, Germany

q-analogs of multiple zeta values (qMZVs) can be seen as generalization of (quasi-)modular forms. Current research in the field of qMZVs focuses on finding $\mathbb{Q}$-linear relations among qMZVs. Some important ones of such relations are called duality relations. In the talk, we will consider and prove duality in the model named to Schlesinger and Zudilin with so-called "connected sums" (not the one of topology!). The latter is a new concept of proving relations (mainly among (q)MZVs) introduced by Seki and Yamamoto in 2019.