Abstracts

Moments of L-functions and the Liouville-Green method

Thur. 10:25

Olga Balkanova
University of Turku

In this talk, we show that the proportion of primitive cusp forms of level one and weight $4k \to \infty$, $k \in \mathbb{N}$ for which the associated L-function at the central point is no less than $(\log k)^{-2}$ is at least 20% for an individual weight and at least 50% on average. The key ingredients of our proof are the Kuznetsov convolution formula and the Liouville –Green method. This is a joint work with Dmitry Frolenkov.

Petersson regularized inner products

Wed. 15:00

Kathrin Bringmann
University of Cologne

We develop a regularization for Petersson inner products for arbitrary weakly holomorphic and meromorphic modular forms. As applications, we extend work of Duke, Imamoḡlu and Toth on regularized inner products of weakly holomorphic modular forms of weights 0 and 3/2, motivate a Hecke structure for weakly holomorphic modular forms and write specializations of Green's functions as inner product.

Thur.
15:00

Periods and asymptotic growth of arithmetic eigenfunctions

Farrell Brumley
Paris 13

Given a compact locally symmetric space Y we are interested in the localization properties of sequences of eigenfunctions of the ring of invariant differential operators. When Y is of non-compact type, quantum chaos suggests that such eigenstates should be delocalized. One concrete expression of this is that a generic sequence of L^2 normalized eigenfunctions should have small sup norm. We call these nicely behaved sequences "tempered" , in analogy with the Ramanujan conjecture from the theory of automorphic forms. We would like to know under what conditions Y admits non-tempered sequences of eigenfunctions, i.e., those whose sup norm grow with a power of the eigenvalue. We provide a fairly complete answer to this question in the arithmetic case, in terms of the recurrence properties of Hecke operators. Our techniques actually pick out the size of certain discrete periods through trace formula methods, and the criterion assuring growth can be read off from the Plancherel measure of an underlying symmetric space G/H. This is joint work with Simon Marshall.

Mon.
14:00

Lattice counting problems in the hyperbolic plane

Dimitrios Chatzakos
University of Bristol

In this talk we focus on two lattice counting problems in the hyperbolic plane. The first one is the hyperbolic analogue of Gauss circle problem, which deals with estimates for the orbit of a point z under the action of a cofinite Fuchsian group Γ on $\mathbb{H}^2$. The second problem is a modification of the hyperbolic Gauss problem, where we restrict counting in a hyperbolic conjugacy class of the group Γ.

We present some of our recent results for the error terms of these two problems. In particular, we discuss our average results for the error term of the conjugacy class problem. Further, we give some mean value and Ω-results for the error terms of both problems. We also explain some of the main ingredients in the proofs of the above results. Time permitting, we will give some arithmetic applications of the conjugacy class problem in quadratic forms.

Mean square of the remainder in the prime geodesic theorem

Mon. 15:00

Giacomo Cherubini
Max Planck Institute, Bonn

I will start with explaining what is the prime geodesic theorem, emphasizing analogies and differences with the prime number theorem, and I will mention what is the currently best known pointwise bound on the remainder, due to Soundararajan and Young.

Then I will explain an ongoing work to obtain upper bounds on the mean square of the remainder, and compare these bounds with the pointwise estimates.

Kernels of L-functions and shifted convolution series

Mon. 16:15

Nikolaos Diamantis
University of Nottingham

We discuss a characterization of the field into which values of L-functions of cusp forms belong. The construction involves shifted convolution series of divisor sums and to establish it we use parts of Brown's technique to study multiple modular values.

Twisted sums of Kloosterman sums, and Dirichlet multiplier systems

Wed. 10:25

Sary Drappeau
Aix-Marseille University

We owe to Deshouillers and Iwaniec some of the most effective known bounds on Kloosterman sums, established by systematic use of Kuznetsov's formula for congruence subgroups. This has led to numerous applications in analytic number theory, for instance in establishing the full asymptotic in the Titchmarsh divisor problem (Fouvry, Bombieri-Friedlander-Iwaniec) In this talk we'll review some of the key steps in these works, and recent progress using Dirichlet multiplier systems to enhance the flexibility of the estimates.

Thur. 11:25

On the first moment of symmetric square L-functions in the weight aspect

Dmitry Frolenkov
Steklov mathematical institute, Moscow

Starting from the work of Iwaniec and Michel, moments of symmetric square L-functions have received a lot of attention. Despite numerous efforts and the variety of methods, in the weight aspect only the first moment has been evaluated asymptotically. All known results for the second moment are obtained by introducing an extra average over weight. During the talk we will briefly discuss previous results and methods used to obtain them. Also a new asymptotic formula for the twisted first moment of symmetric-square L-functions at the critical point in the weight aspect will be presented.

This is a joint work with Olga Balkanova.

Mon. 11:25

The sup-norm problem for $GL(2)$ over number fields

Gergely Harcos
Rényi Institute of Mathematics

I will discuss non-trivial bounds for the sup-norm of spherical Hecke-Maass newforms of square-free level for the group $GL(2)$ over a number field. The talk is based on joint work with Valentin Blomer, Péter Maga, Djordje Milićević.

Thur. 16:15

On an extension of a formula of Katok and Sarnak

Özlem Imamoḡlu
ETH Zürich

In this talk I will report on joint work with W. Duke and A. Toth in which give an extension of the formula of Katok and Sarnak relating cycle integrals of Maass forms to coefficients of half integral weight forms.

On the analytic continuation of the hyperbolic heat kernel

Tues. 9:15

Jürg Kramer
Humboldt-Universitt zu Berlin

In our talk we will explain work in progress on variations of the analytic continuation of the hyperbolic heat kernel for Riemann surfaces of finite volume to the right half-plane. Preliminary results indicate that there is a variant that allows an optimal control of the behavior of the analytically continued heat kernel when approaching the imaginary axis. Such results will have potential applications to bound the sup-norm of Maass forms.

Quantum Ergodicity for point scatterers on arithmetic tori

Fri. 11:25

Pär Kurlberg
KTH, Stockholm

The Seba billiard was introduced to study the transition between integrability and chaos in quantum systems. The model seems to exhibit intermediate level statistics (i.e., repulsion between nearby eigenvalues, though not as strong as predicted by random matrix theory), as well as Gaussian value distribution of eigenfunctions ("wave chaos"). We investigate the very closely related "toral point scatterer"-model, namely eigenfunctions of the Laplacian perturbed by a delta-potential, on arithmetic 2D-tori. For a full density subsequence of "new" eigenfunctions we prove decay of matrix coefficients associated with pure momentum observables. This, together with previous work by Rudnick-Ueberschaer, allows us to conclude that quantum ergodicity holds for the set of "new" eigenfunctions. In particular, almost all new eigenfunction are equidistributed in both the position and the momentum representation. Time permitting we will also discuss some "scar" constructions (i.e., sequences of eigenfuntions that do not equidistribute) for tori with irrational aspect ratios.

Fri.
9:15

Lattice Point Counting in Sectors of Hyperbolic Space

Niko Laaksonen
KTH, Stockholm

Huber demonstrated how the hyperbolic lattice point problem in conjugacy classes corresponds to counting lattice points in a sector of the hyperbolic plane. This is equivalent to counting geodesic segments according to length. For this problem, Good and Chatzakos–Petridis proved separately an error term analogous to that of Selberg.

We show how this generalises to three dimensions and prove a similar strong bound on the error term. We will also apply the work of Chamizo on large sieve inequalities in hyperbolic spaces to our problem in the radial and spatial aspects. In particular, we will discuss why these yield diminishing returns in higher dimensions.

Tues.
14:00

On the non-vanishing of twisted L-functions

Philippe Michel
EPFL, Lausanne

In a series of recent works Blomer, Fouvry, Kowalski, Milicevic, Sawin and myself have been able to solve the longstanding problem of evaluating asymptotically the second moment of the central values for the family of character twists (of large prime conductor) of the L-function of a fixed modular form; as is well known this opens the door to the evaluation of more general (twisted) moments and making it possible to apply either the mollification or the resonance method.

We will discuss this evaluation along with some applications to the non-vanishing of these central values.

Tues.
15:00

Quantum variance of p-adic microlocal lifts

Paul Nelson
ETH Zürich

This talk will concern the statistical behavior of automorphic forms on compact arithmetic quotients of $\mathrm{GL}_2(\mathbb{Q}_p)$. I will give a definition of "microlocal lifts" on such quotients, explain its relation to the classical theory of newforms, and indicate its relevance to the quantum unique ergodicity and subconvexity problems. I will then discuss some results concerning the quantum variance of families of such microlocal lifts and indicate the role played by theta functions in their proof.

Cubic Moments of L-functions and the Petersson formula for newforms

Wed. 16:15

Ian Petrow
EPFL, Lausanne

In this talk I will present joint work with M.P. Young in which we use a cubic moment to prove a Weyl-type subconvexity bound for the central L-values of quadratic twists of a newform of square-free level, trivial nebentypus, and arbitrary even weight. This generalizes work of Conrey and Iwaniec. I will emphasize a new tool which we developed to prove these estimates: a more general version of the Petersson formula for newforms of square-free level.

Transfer operator approaches to automorphic functions, resonances, and Selberg zeta functions

Wed. 9:15

Anke Pohl
University of Jena

We report on the current status of a program to develop transfer operator approaches to automorphic functions, resonances, and Selberg zeta functions for non-compact hyperbolic surfaces of finite or infinite area and finite-dimensional unitary representations.

Non-vanishing of L-functions

Tues. 11:25

Nicole Raulf
Université Lille 1

The non-vanishing of automorphic L-functions is a very important topic in number theory as it has many arithmetic and geometric consequences. One example for this is the Birch and Swinnerton-Dyer conjecture. Of similar interest is the simultaneous non-vanishing of the product of two automorphic L-functions at the central point. In this talk we will discuss such a problem. This is joint work with G. Bhowmik and J. Sengupta.

Lattice points counting and bounds on periods of automorphic functions

Wed. 14:00

Andre Reznikov
Bar-Ilan University

I discuss a "soft" proof for non-trivial (i.e., beyond "convexity") bounds on spherical, hyperbolic and unipotent Fourier coefficients of a fixed Maass form for a general co-finite lattice in $PGL(2,\mathbb{R})$. The method is based on the amplification by the Airy type phenomenon for corresponding matrix coefficients and an effective Selberg type pointwise asymptotic for the lattice points counting in various homogeneous spaces of the group $PGL(2,\mathbb{R})$. Surprisingly, this requires only L^2 theory.

On a connection between certain problems in the theory of L-functions and an additive problem

Thurs. 9:15

Irina S. Rezvyakova
Steklov Mathematical Institute, Moscow

In our talk we shall discuss how the methods developed by Atle Selberg in the theory of L-functions reduce certain problems on distribution of non-trivial zeros of L-functions to a solution of an additive problem with the coefficients of the given L-function. We shall formulate results for L-functions attached to automorphic forms.

Sup norms of Maass forms of powerful levels

Thur. 14:00

Abhishek Saha
University of Bristol

The asymptotic behavior of eigenfunctions of the Laplacian on Riemannian manifolds plays an important role in various areas of mathematics, including semi-classical analysis, spectral theory, geometry, and number theory. While there has been a lot of work in the large eigenvalue limit (where the manifold is kept fixed), it is also very interesting to consider the case when the manifold itself varies, e.g., by taking quotients of a (fixed) symmetric space with lattices whose co-volume goes to infinity. Restricting ourselves to the arithmetic case (where one can exploit the action of Hecke operators), this gives rise to the problem of understanding the asymptotics of automorphic forms on semi-simple groups in the large conductor (level) aspect. In recent years, there has been a fair bit of progress on this problem

in the simplest case, i.e., for classical Maass forms. A particularly interesting case, full of rich new phenomena, is that of powerful levels (where the level is no longer squarefree) and in particular the depth aspect, where the conductor of the form varies over larger and larger powers of some fixed prime. I will talk about some of my recent results in this area, and specifically focus on some interesting features that occur for powerful levels. In particular, in the depth aspect, one can reduce large aspects of the problem to purely local questions (such as the asymptotics and bounds for local Whittaker newforms and matrix coefficients) about highly ramified representations of $GL_2(\mathbb{Q}_p)$.

Dimension formulas for Hilbert modular forms and Shimizu L-functions

Tues. 10:25

Fredrik Strömberg
University of Nottingham

I will present results from joint work with Nils Skoruppa on explicit dimension formulas for (vector-valued) Hilbert modular forms and in particular I will talk about the parabolic terms, which involve special values of twisted Shimizu L-functions.

The generalized circle problem for a random lattice in large dimension

Tues. 16:15

Anders Södergren
Örebro University

The generalized circle problem asks for the number of lattice points of an n-dimensional lattice inside a large Euclidean ball centered at the origin. In this talk we discuss the error term R in the generalized circle problem for a ball of volume x and a random lattice L of large dimension n. The main result is a central limit theorem for R in the limit as n and x simultaneously tend to infinity, with x growing sub-exponentially with respect to n. The proof goes via convergence of moments, and for the computations we develop a new version of C. A. Rogers' mean value formula over the space of lattices.

This is joint work with Andreas Strömbergsson.

Kronecker limit type formulas for non-holomorphic Eisenstein series

Wed. 11:25

Anna von Pippich
TU Darmstadt

Classically, for $\mathrm{PSL}_2(\mathbb{Z})$, Kronecker's limit formula evaluates the special value of the non-holomorphic parabolic Eisenstein series at $s = 0$ in terms of the logarithm of the absolute value of Dedekind's Delta function. In this talk, we report on Kronecker limit type formulas for elliptic and hyperbolic Eisenstein series for Fuchsian subgroups. Using the theory of Borcherds products, we obtain explicit formulas for the group $\Gamma_0(N)$.

Nodal intersections of random toral eigenfunctions with a test curve

Fri. 10:25

Igor Wigman
King's College London

This talk is based on joint works with Zeev Rudnick, and Maurizia Rossi.

We investigate the number of nodal intersections of random Gaussian Laplace eigenfunctions on the standard 2-dimensional flat torus ("arithmetic random waves") with a fixed reference curve. The expected intersection number is universally proportional to the length of the reference curve, times the wavenumber, independent of the geometry.

Our first result prescribes the asymptotic behaviour of the nodal intersections variance for generic smooth curves in the high energy limit; remarkably, it is dependent on both the angular distribution of lattice points lying on the circle with radius corresponding to the given wavenumber, and the geometry of the given curve. For these curves we can prove the Central Limit Theorem. In a work in progress we construct some exceptional examples of curves where the variance is of smaller order of magnitude, and the limit distribution is non-Gaussian.
