Abstracts

Michael Baake (Universität Bielefeld)

A cocycle approach to the Fourier transform of Rauzy fractals and the point spectrum of Pisot inflation tilings

Abstract: It is well known that—and how—a Pisot substitution gives rise to a self-similar inflation tiling in Euclidean space whose control points constitute a Meyer set. In general, the spectrum of the corresponding dynamical system can be of mixed type, but will always have a non-trivial pure point part. The corresponding eigenfunctions are related to the Fourier–Bohr coefficients of the spatial structure, which in turn can be expressed via the Fourier transform of certain Rauzy fractals. Unfortunately, it is rather difficult to compute and analyse these transforms.

In this talk, which is based on joint work with Uwe Grimm (Milton Keyens) and Nicolae Strungaru (Edmonton), we explain the setting and show a cocycle approach to a matrix Riesz product formula for the Fourier transform of such Rauzy fractals. Due to its exponentially fast, compact convergence, it becomes possible to compute such Fourier transforms efficiently, and with arbitrary precision. Moreover, a combination with a uniform distribution result leads to the Eberlein decomposition of the autocorrelation measure of induced dynamical system, and hence to a rather explicit spectral decomposition.

Viviane Baladi (CNRS)

There are no deviation to the ergodic integrals of Giulietti–Liverani flows on the two-dimensional torus

Abstract: Inspired by the work of Flaminio and Forni for constant negative curvature geodesic flows, Giulietti and Liverani introduced a class of uniquely ergodic flows associated with Anosov diffeomorphisms $F$ of the torus $T^2$, and obtained expansions for their ergodic integrals in terms of the spectral data of the transfer operator of $F$. Using the Artin–Mazur zeta function and suitable anisotropic spaces, we show that this transfer operator has no non-trivial eigenvalues, and therefore there are no deviations to the ergodic integrals. Our proof also gives information on the speed of mixing of the measure of maximum entropy of Anosov diffeomorphisms of the torus $T^2$. 
Spectral approximation of transfer operators

Abstract: The talk will be concerned with the problem of how to approximate spectral data of transfer operators, in particular those arising in applications to number theory. I will focus on an easily implementable Galerkin type method using Lagrange–Chebyshev interpolation and its convergence properties.

Roelof Bruggeman (Universiteit Utrecht)

Transfer operator and eigenvalues of automorphic forms

Abstract: I'll give an example of the interaction between the study of a transfer operator and the theory of real-analytic modular forms. It concerns work of D.Mayer, M.Fraczek and me published in 2013. On the one hand, explicit computations of 1-eigenvalues of a family of transfer operators give information on families of automorphic forms. On the other hand, the spectral theory of automorphic forms provides information that explains some structure visible in the computational results.

YoungJu Choie (Pohang University of Science and Technology)

Generating functions of Periods of Modular forms

Abstract: A closed formula for the sum of all Hecke eigenforms on $\Gamma_0(N)$, multiplied by their odd period polynomials in two variables, as a single product of Jacobi theta series for any squarefree level $N$ is known. When $N = 1$ this was result given by Zagier in 1991. We discuss a more general result in this direction.

Manfred Denker (Universität Göttingen)

Toral automorphisms driven by continued fractions

Abstract: Two irrational numbers $\alpha_+ \in (0, 1)$ and $\alpha_- \in (0, \infty)$ define a two-sided infinite string of integers in a canonical way, where its members $a_n$ are given by their partial quotients. In this way a sequence of toral automorphisms $\begin{pmatrix} 0 & 1 \\ 1 & a_n \end{pmatrix}$ is well defined.

The talk will discuss questions associated to a ‘quenched’ Poisson limit of such sequences. In particular, the method of proof uses Chen’s approach and goes beyond the traditional approach using transfer operators and discusses return sets which are not necessary geometric or symbolic balls. The transfer operator method is replaced by homoclinic groups and the geometry of sets is determined by Steiner’s theorem.

This work is jointly with the late M. Gordin.

Rhiannon Dougall (University of Bristol)

Comparison of entropy for infinite covering manifolds, and group extensions of subshifts of finite type
Abstract: A classical example of an Anosov flow would be the geodesic flow associated to a compact hyperbolic manifold $M$. The periodic orbits are then closed geodesics in $M$, and this topic has a rich history. In general Anosov flows are not so well behaved, there may be infinitely many periodic orbits in a free homotopy class, in contrast to geodesic flows. Nevertheless one has results on the asymptotic number of periodic orbits up to period $T$. In this talk we will discuss the problem of counting periodic orbits in infinite covering manifolds, where we relate the exponential growth rate of periodic orbits in the cover to properties of the covering group. Such results are rooted in analogous statements for group extensions of subshifts of finite type. Featuring joint work with Richard Sharp.

Charlene Kalle (Leiden University)

Symmetric doubling maps and the frequency of 0 in signed binary expansions

Abstract: In this talk we consider a one-parameter family of dynamical systems that generate binary expansion of numbers using digits -1, 0 and 1. By the Birkhoff Ergodic Theorem the frequency of the digit 0 in typical expansions can be determined from an invariant measure that is equivalent to the Lebesgue measure. We use a surprising relation between this family of maps and Nakada’s continued fraction maps to obtain an explicit expression for the density of such a measure. Then we identify the region in the parameter space where the frequency of the digit 0 in typical signed binary expansions is as large as possible.

Michael Magee (Durham University)

Thermodynamical formalism and Markoff-Hurwitz equations

Abstract: Beginning with the simple question ‘when is the sum of the squares of a tuple of integers equal to a multiple of their product?’, one arrives at a family of Diophantine equations called Markoff-Hurwitz equations. I’ll explain how the problem of counting integer solutions to these equations can be studied using transfer operators and the thermodynamical formalism. This leads to new connections between Diophantine geometry and certain fractals including the ‘Rauzy gasket’: a fractal that shows up in disparate areas of mathematics including triply periodic surfaces, dynamics of maps on the circle, higher dimensional generalizations of continued fractions, Teichmuller theory, and now, in Diophantine geometry. This is joint work with Alex Gamburd and Ryan Ronan.

Luca Marchese (AMS Università di Bologna)

Dimension of Bad sets for non-uniform Fuchsian lattices

Abstract: The set of real numbers which are badly approximable by rationals admits a exhaustion by sets $\text{Bad}(c)$, whose dimension converges to 1 as $c$ goes to zero. D. Hensley computed the asymptotic for the dimension up to the first order in $c$, via an analogous estimate for the set of real numbers whose continued fraction has all entries uniformly bounded. We will consider diophantine approximations by parabolic fixed points of any non-uniform lattice in $\text{PSL}(2, \mathbb{R})$ and in particular a natural notion of $c$-badly approximable points. I will describe a continued fraction algorithm adapted to this setting and introduce the associated transfer operator. Bowen’s formula gives the first order in $c$ for the dimension of the set of $c$-badly approximable points.

Frédéric Naud (Sorbonne Université)
Spectral gaps of random covers of hyperbolic surfaces

Abstract: We will define a notion of random (infinite area) hyperbolic surfaces and explain the relevant notion of spectral gap for the resonances of the Laplacian. We will then explain our main result (joint work with Michael Magee) which is a probabilistic version of Selberg’s $3/16$ theorem. Proof uses, among other things, transfer operators and zeta functions.

Hans Henrik Rugh (University of Paris-Saclay)

Regularized Fredholm determinants

Abstract: We consider families of real-analytic contracting maps with one member having a neutral fixed point. We study the spectrum of an associated transfer operator through a regularized Fredholm determinant. In general this determinant admits a holomorphic continuation to a multi-sheeted Riemann surface which we will describe in the talk.

Richard Sharp (University of Warwick)

Equidistribution of null-homologous periodic orbits

Abstract: A well-known result of Bowen says that the periodic orbits of a hyperbolic flow become, on average, equidistributed with respect to the measure of maximal entropy as the periods tend to infinity. By introducing weightings, Parry showed that other Gibbs states could arise as limits in this way. We will discuss what happens if we consider Anosov flows and restrict to periodic orbits which are trivial in homology.

Hae-Sang Sun (Ulsan National Institute of Science and Technology)

Modular partition vectors over an interval

Abstract: Modular partition vector is a generalization of the length of continued fraction to a non-trivial congruence subgroup. It was shown that its distribution over the unit interval is asymptotically Gaussian. In the talk, I will discuss the distribution over a sub-interval. A main ingredient is the introduction of an interval operator that is a variant of a weighted transfer operator on the space of continuously differentiable functions on the unit interval. I will discuss one consequence towards a classical problem, namely the distribution of modular inverses. This is joint work with Jungwon Lee.

Mike Todd (University of St. Andrews)

Escape of entropy

Abstract: In many classical compact settings, entropy is upper semicontinuous, i.e., given a convergent sequence of invariant probability measures, the entropy of the limit measure is at least the limsup of the entropies of the sequence. There are only a few results of this type for non-compact cases since both mass and entropy can escape. In this talk I will describe how this can happen in the context of countable Markov shifts and give continuity results recently proved with Godofredo Iommi and Anibal Velozo.
Holomorphic quantum modular forms

Abstract: Quantum modular forms, which occur in connection with many number-theoretical problems but also with quantum invariants of knots, are functions on the rational numbers having a somewhat non-standard weak modularity property. There are also holomorphic functions that have an analogous property and that also occur in connection with quantum invariants of knots as well as in several places in number theory. The talk will try to explain the concept and give several applications and examples, including odd weight Eisenstein series for SL(2, Z) and a simpler interpretation of the cohomology classes ("periods") associated to Maass cusp forms in earlier joint work with Roelof Bruggeman and John Lewis.