Student Conference on Automorphic Forms and Eisenstein Series

September 20-21, 2014
TU Darmstadt

Organizers   **Claudia Alfes**   **Fabian Völz**

TECHNISCHE
UNIVERSITÄT
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Saturday, Sept. 20, 2014

Time	Speaker	Title of Talk
12:30-13:00		– Registration –
13:00-14:00	Funke	*A very basic introduction to Eisenstein cohomology, Part I*
14:10-14:40	Li	*Hilbert Eisenstein Series and Doi-Naganuma Lift*
14:45-15:15	Gallenkämper	*Hecke Theory for the Orthogonal Group $O(2,3)$*
15:15-16:00		– Coffee Break –
16:00-17:00	Bouganis	*Arithmetic of Siegel-type Eisenstein Series, Part I*
17:10-17:40	Walls	*An Introduction to the Theta Correspondence*
17:45-18:15	Neururer	*Eichler cohomology in arbitrary weight*
18:30- ...		– Informal Conference Dinner –

Sunday, Sept. 21, 2014

Time	Speaker	Title of Talk
09:00-10:00	Funke	*A very basic introduction to Eisenstein cohomology, Part II*
10:00-10:45		– Coffee Break –
10:45-11:15	Crawford	*A singular theta lift for higher weights*
11:20-11:50	Dickson	*The Satake compactification of level N Siegel modular varieties and Hecke action on Klingen-Eisenstein series*
11:55-12:25	Meneses-Torres	*Constructive and geometric aspects of vector-valued cusp forms of weight 2*
12:30-14:20		– Lunch Break –
14:20-15:20	Bouganis	*Arithmetic of Siegel-type Eisenstein Series, Part II*
15:30-16:00	Bachmann	*Shuffle regularized multiple Eisenstein series and the Goncharov coproduct*
16:00-16:45		– Coffee Break –
16:45-17:15	De Gaetano	*On the Laplacian on automorphic forms of higher weight*
17:20-17:50	Grados	*Estimates of canonical Green's functions*

2 Location

The lectures and talks will take place in

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which is situated on the ground floor of the department, Schlossgartenstraße 7, 64289 Darmstadt. The registration will be at the entrance of the building. The location for the informal conference dinner is the Pub "The Green Sheep", Erbacher Straße 5, 64283 Darmstadt.

3 Abstracts

Jens Funke
A very basic introduction to Eisenstein cohomology
University of Durham, United Kingdom

Abstract: I will attempt to give a glimpse of Harder's theory and basic ideas concerning Eisenstein cohomology and his related conjectures which predict far reaching generalizations of the famous congruence for the Ramanujan's τ-function.

Yingkun Li
Hilbert Eisenstein Series and Doi-Naganuma Lift
University of Cologne, Germany

Abstract: In 1924, Hecke introduced a non-holomorphic Hilbert Eisenstein series of parallel weight one in order to produce a holomorphic Eisenstein series. However, an unfortunate sign mistake resulted in him producing the zero function. In 2005, Yang used coherent Eisenstein series to construct these holomorphic Hilbert Eisenstein series of parallel weight one in the spirit of Hecke. In this talk, we will discuss this construction in the real-quadratic case and consider its relationship to the Doi-Naganuma lifting.

Jonas Gallenkämper
Hecke Theory for the Orthogonal Group $O(2,3)$
RWTH Aachen University, Germany

Abstract: Let $t \in \mathbb{N}$ be squarefree and $S_t := \left(\begin{smallmatrix} 0 & 1 \\ 1 & 0 \end{smallmatrix}\right) \perp \left(\begin{smallmatrix} 0 & 1 \\ 1 & 0 \end{smallmatrix}\right) \perp (-2t)$. We consider

$$M_t(m) := \left\{ M \in \mathbb{Z}^{5\times 5} : M^t S_t M = m^2 S_t \right\}, \quad \Gamma_t := M_t(1) \quad \text{and} \quad \mathscr{M}_t := \bigcup_{m \in \mathbb{N}} M_t(m).$$

The Hecke algebra $\mathscr{H} := \mathscr{H}(\Gamma_t, \mathscr{M}_t)$ is the tensor product of its p-primary components $\mathscr{H}_p := \mathscr{H}(\Gamma_t, \cup_{k\in\mathbb{N}_0} M_t(p^k))$. These p-primary components are polynomial rings over $\mathbb{Z}$ in

$$\Gamma_t \operatorname{diag}(1,1,p,p^2,p^2)\Gamma_t, \quad \Gamma_t \operatorname{diag}(1,p,p,p,p^2)\Gamma_t \quad \text{and} \quad \Gamma_t \operatorname{diag}(p,p,p,p,p)\Gamma_t$$

which are algebraically independent.

It is well known that the orthogonal group $O(2,3)$ is isomorphic to the maximal discrete extension Σ_t of the paramodular group of degree two and level t. We want to transfer this result to the Hecke algebra $\widehat{\mathscr{H}}$ for Σ_t. Presently, this assertion is proven for $t = 1$, where the Hecke operators on both sides correspond to each other. The conjecture is that it holds for all squarefree t.

Thanasios Bouganis
Arithmetic of Siegel-type Eisenstein Series
University of Durham, United Kingdom

Abstract: The aim of these two lectures is to discuss the work of Shimura on the arithmetic properties of Siegel-type Eisenstein series of the symplectic group over the rationals. These are Eisenstein series associated to the standard Siegel parabolic, and form generalization of the classical Eisenstein series of SL_2. We will focus on questions regarding their analytic continuation, holomorphicity and their Fourier expansion coefficients. We will also discuss the closely related notion of nearly holomorphic Eisenstein series. Depending on time we will also indicate the applications of these Eisenstein series to the standard L functions of Siegel modular forms as well as generalization of the above questions to other type of Eisenstein series (Klingen-type).

Patrick Walls
An Introduction to the Theta Correspondence
McMaster University Hamilton, Canada

Abstract: We will introduce the Weil representation, dual pairs and the theta correspondence over local fields. Our focus will be mainly on examples and common constructions in the theory.

Michael Neururer
Eichler cohomology in arbitrary weight
University of Nottingham, United Kingdom

Abstract: I will start with an introduction to classical Eichler cohomology, which has many applications in the study of modular forms and their L-functions. Then I will talk about an analouge of this theory for modular forms of general real weights.

Jonathan Crawford
A singular theta lift for higher weights
University of Durham, United Kingdom

Abstract: In this talk, we will discuss the construction and properties of a singular theta lift of harmonic weak Maass forms of weight $3/2 - k$ (where k is a positive integer). Using this we obtain some automorphic objects of weight $2 - 2k$, so-called "locally harmonic Maass forms", which are locally harmonic, but have singularities along certain geodesics. Via some natural differential operators we can relate the lift to the Shimura correspondence. For some kind of Poincare series, this lift was considered by Bringmann, Kane and Viazovska. My work generalizes work of Hövel for the case $k = 1$ to higher weight.

Martin Dickson
The Satake compactification of level N Siegel modular varieties and Hecke action on Klingen-Eisenstein series
University of Bristol, United Kingdom

Abstract: We recall the construction of the Satake compactificaton of Siegel modular varieties, and describe the boundary explicitly in the case of square-free level. We then use this, together with how the action of Hecke operators intertwines with the process of restricting to the boundary components, to describe the action of Hecke operators on the space of Klingen-Eisenstein series.

Claudio Meneses-Torres
Constructive and geometric aspects of vector-valued cusp forms of weight 2
Max Planck Institute for Mathematics, Germany

Abstract: Let Γ be a Fuchsian group of the first kind with a unitary representation ρ. Upon explaining a way to construct the classical vector-valued Poincaré series of weight 2, and how an explicit basis for these can be prescribed in the genus 0 case, I will describe how a particular case of the Eichler-Shimura isomorphism manifests geometrically as the differential of the map from a moduli space of stable parabolic bundles to the corresponding unitary character variety.

Henrik Bachmann
Shuffle regularized multiple Eisenstein series and the Goncharov coproduct
University of Hamburg, Germany

Abstract: In this talk we present a recent result which gives a connection of the Fourier expansions of multiple Eisenstein series and the Goncharov coproduct. We use this connection to give a definition of shuffle regularized multiple Eisenstein series which generalizes the multiple Eisenstein series and which satisfy the shuffle product. This is based on a joint work with K. Tasaka.

Giovanni De Gaetano
On the Laplacian on automorphic forms of higher weight
Humboldt University of Berlin, Germany

Abstract: First introduced by Maass in 1952, the automorphic Laplacian in higher weight plays a significant role not only in the theory of automorphic forms but also in many other fields, ranging from string theory to algebraic geometry. After defining this operator I will set out some results on its spectral theory. Moreover, I would like to discuss what I still don't know on the subject; specifically, lead and inspired by the special case of the hyperbolic Laplacian, how the automorphic one behaves under conformal transformations.

Miguel Grados
Estimates of canonical Green's functions
Humboldt University of Berlin, Germany

Abstract: Towards the end of the 90's A. Abbes and E. Ullmo provided, for the case of modular curves, an explicit formula for canonical Green's functions $g_{can}(z, w)$ evaluated at two different cusps. In this talk, we will see the main role played by Eisenstein series in the determination of estimates for $g_{can}(0, \infty)$ when the congruence subgroup is $\Gamma(N)$.

4 Participants

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