Universität
Bremen

Women in automorphic forms 2025

University of Bremen, September 10-12, 2025

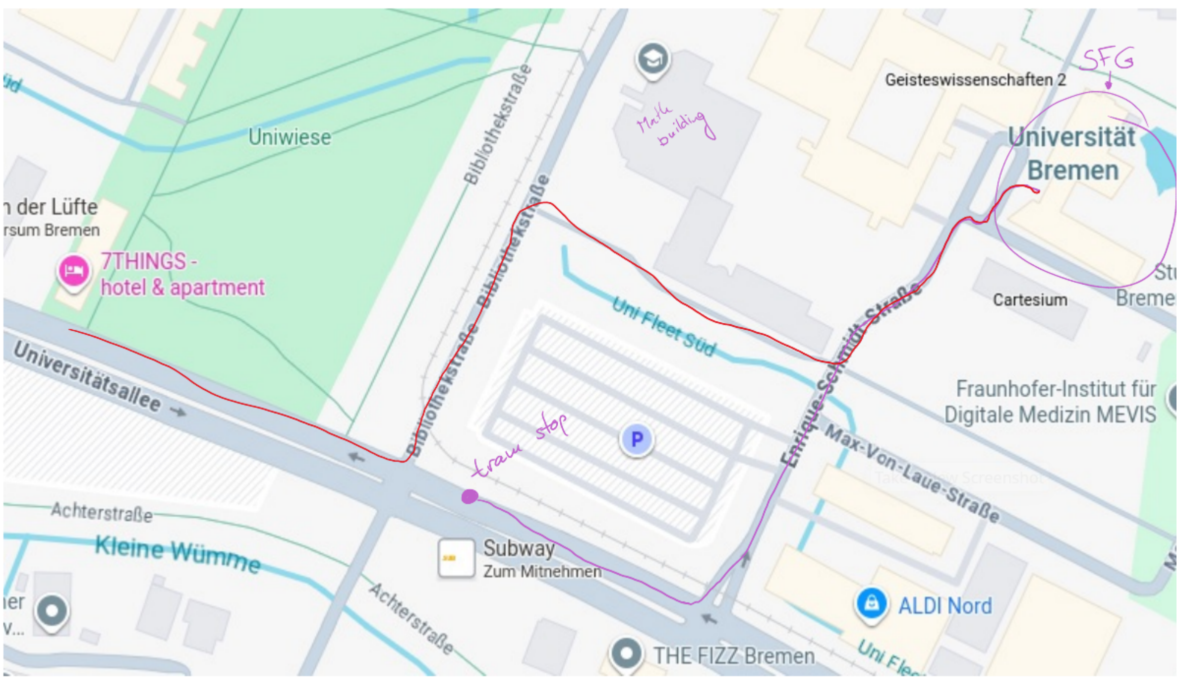
Program booklet

1 Location and directions

WIAF takes place in the building SFG (Seminar- und Forschungsverfügungsgebäude), room 2070. This is how the building looks like:

`http://unihb.eu/SFG`

If you arrive by tram 6, the best stop is *Universität Süd*. If you stay at 7Things, you can just walk. In the picture below, possible ways are indicated:



2 Schedule

	Day 1 (Wed)	Day 2 (Thur)	Day 3 (Fr)
8:30–9:00	Registr/Open		
09:00–09:50	**Botero**	**Bringmann**	2 Short talks (start: 9:20)
10:00–10:30	*Coffee break*	*Coffee break*	*Coffee break*
10:30–11:20	**Im**	**Kara**	**Smajlovic**
11:30–12:30	3 Short talks	3 Short talks	**Pati**
12:30–14:00	*Lunch break*	*Lunch break*	*Lunch break*
	14:00–14:50 **Klinger-Logan**	14:00-14:30 Discussions 14:30–15:00 *Coffee break*	Departure
	15:00–15:30 *Coffee break*	15:00–15:50 **Choie**	
afterwards	Free disc.	Free disc.	
	Conference dinner		

Some bits of information:

- Plenary talks are 50 min. There are additional 10 min for questions.
- Short talks are 15 min and 5 extra minutes for questions.
- Please do not go overtime!
- We have available beamer as well as chalkboards.
- Posters will be displayed throughout in the room for coffee breaks.
- Short talks on Wednesday (in this order): Begum Gulsah Cakti, Carlotta Hohaus
- Short talks on Thursday (in this order): Swati, Rashi Lunia, Oana Padurariu
- Short talks on Friday (in this order): Naomi Tanabe, Yasuko Hasegawa

3 Plenary talks

Ana Botero (Bielefeld University): *The adelic theta divisor over the moduli space of abelian varieties*

Let g $\in \mathbb{Z}_{\geq 1}$ and let N_g the stack parametrizing abelian schemes together with a theta divisor. The universal family $N_{g,1}$ comes with a universal theta divisor Θ. Using tools from logarithmic and tropical geometry we construct a log stack $\overline{N}_{g,1}^{\mathrm{trop}}$ parametrizing log abelian varieties satisfying some monodromy conditions dictated by a tropical theta function. By work of Yuan and Zhang, Θ naturally extends as an adelic line bundle Θ^{ad} on $N_{g,1}$ and the main goal of the talk is to relate Θ^{ad} to the divisor of the tropical theta function. As corollary, we obtain information about the degeneration behaviors of the Riemann theta function. This is joint work with J. Burgos, D. Holmes and R. de Jong.

Kathrin Bringmann (Universität zu Köln): *Moments of partitions into distinct parts*

In this talk I will discuss joint work with B. Kim and E. Kim on certain combinatorial statistic, investigate their asymptotics and the modular properties of their generating functions.

YoungJu Choie (POSTECH): *Ramanujan Function and Lewis-Zagier Theory*

The Lost Notebook of Ramanujan contains a number of beautiful formulas, one of which can be found on its page 220. It involves an interesting function, which we denote as $\mathcal{F}_1(x)$. It turns out that $\mathcal{F}_1(x)$ belongs to the category of period functions as it satisfies the period relations of Maass forms in the sense of Lewis and Zagier. Moreover, it is also true that $\mathcal{F}_1(x)$ is a Hecke eigenfunction under the action of Hecke operators on the space of periods. We also establish that it naturally appears in a Kronecker limit formula of a certain zeta function, revealing its connections to various topics. This expository talk is based on joint work with R. Kumar.

Bo-Hae Im (KAIST): *The rank growth of abelian varieties and Larsen's conjecture*

The rank of an elliptic curves over a number field or more generally, of an abelian variety over a number field is one of the important research topic in number theory. We will discuss the historical progress on the rank of abelian varieties over certain infinite extensions of a number field, especially we will introduce Larsen's conjecture and its progress.

Yasemin Kara (Boğaziçi University): *Solving Diophantine Equations via Modular Approach*

The asymptotic Fermat conjecture (AFC) states that for a number field K not containing ζ_3, there is a bound B_K depending only on the field K such that for all prime exponents $p > B_K$, the equation $x^p + y^p + z^p = 0$ has only trivial solutions. The strategy which is referred as the "modular method" to solve the Fermat equation, used by Wiles in his famous proof, can be adapted to attack AFC and its several different generalizations. Similar results are rare for other Diophantine equations of type $x^p + y^q = z^r$ although the solutions of this equation have been studied over rationals. In this talk, we will explain how the method works and mention some recent asymptotic results for Diophantine equations with coefficients A, B, C of type $Ax^p + By^q = Cz^r$ over number fields by assuming some standard modularity conjecture. Moreover, we will illustrate how the asymptotic bound can be computed explicitly for some specific number fields.

Kim Klinger-Logan (Kansas State University): *Differential equations in automorphic forms, convolutions of divisor functions, and their applications to physics*

Physicists such as M. Green, et al., have shown that the behavior of gravitons (hypothetical particles of gravity represented by massless string states) is closely related to automorphic forms. Specifically, solutions f to $(\Delta - \lambda)f = E_a E_b$ on $SL_2(\mathbb{Z})\backslash\mathfrak{H}$ where $\Delta = y^2(\partial_x^2 + \partial_y^2)$ and E_s is a nonholomorphic Eisenstein series appear as coefficients in the low-energy expansion of the scattering amplitude of four gravitons. In this talk we will give a brief overview of the current methods used to find solutions to such differential equations. With K. Fedosova and D. Radchenko, we discovered that the Fourier expansion of the solutions f gives rise to particular infinite convolution sums of divisor functions which yield Fourier coefficients of modular forms. This result has physical implications and extensions which we will discuss if time permits. The work discussed in this is in collaboration with Ksenia Fedosova, Stephen D. Miller, Danylo Radchenko, and Don Zagier.

Maria Rosaria Pati (University of Genova): *Perrin-Riou's main conjecture for modular forms*

In this talk, I will state and sketch a proof of the counterpart for a higher (even) weight newform f of Perrin-Riou's Heegner point main conjecture for elliptic curves ("Heegner cycle main conjecture" for f). Our strategy of proof builds on ideas of Bertolini and Darmon, as elaborated by Howard, and consists in the construction of a so-called bipartite Euler system, that is a collection of cohomology classes and p-adic L-functions attached to congruent modular forms. This is joint work with Matteo Longo and Stefano Vigni.

Lejla Smajlovic (University of Sarajevo): *Niebur-Poincaré series: inner products and generating functions*

In this talk we provide an overview of certain analytic and arithmetic properties of the Niebur-Poincaré series associated to a Fuchsian group of the first kind with at least one cusp. Then, we turn our attention to the Petersson inner product of those series with the (regularized) Green's function and discuss why its evaluation can be viewed as a generalization of the Rorlich-Jensen formula to any Fuchsian group of the first kind (with at least one cusp). Then, we study a generating function of the Niebur-Poincaré series and a generating function of its derivative at $s = 1$. Both functions depend upon two variables in the upper half-plane. We prove that, for any Fuchsian group of the first kind, the generating function in each variable is a polar harmonic Maass form of a certain weight and describe its polar part. Moreover, we prove that the generating function of the derivative of the Niebur-Poincaré series at $s = 1$ can be expressed, up to a certain function appearing in the Kronecker limit formula, as a derivative of an automorphic kernel associated to a point-pair invariant $k(u) = \frac{1}{2\pi}(L(-u) + \pi^2/6)$, where L signifies the Rogers dilogarithm.

4 Short talks

Begum Gulsah Cakti: *Explicit Bounds for the Asymptotic Generalized Fermat Conjecture over Quadratic Fields*

The asymptotic generalized Fermat conjecture (AGFC) predicts that for a number field K, and non-zero elements A, B, C of $\mathcal{O}_K$ such that $A\omega_1 + B\omega_2 + C\omega_3 \neq 0$ for any root of unity $\omega_1, \omega_2, \omega_3$ in K, there is a constant $\mathcal{B}(K, A, B, C)$ such that for all primes $p > \mathcal{B}(K, A, B, C)$, the equation $Ax^p + By^p + Cz^p = 0$ has only trivial solutions in K. Even though there has been promising progress in proving AGFC over general number fields, it remains unclear whether the bound $\mathcal{B}(K, A, B, C)$ is effectively computable. In this talk, using the modular approach, we will study the equation $d^r x^p + y^p + z^p = 0$ over small quadratic fields $\mathbb{Q}(\sqrt{d})$ of class number one. While discussing the differences between working over real quadratic or imaginary quadratic fields, we will show that the AGFC holds for this case. Moreover, we will explore how the bounds $B(K)$ in our results are effectively and explicitly computable.

Yasuko Hasegawa: *The Schubert-Eisenstein series on* Sp(2)

D. Bump, YoungJu Choie and others have been studying the Schubert Eisenstein series. I would like to specialize it to the Eisenstein series on Sp(2) and show some analytic properties of it. Specifically, by computing the Fourier expansion of the Eisenstein series, its analytic properties can be written in terms of well-known functions.

Carlotta Hohaus: *Isomorphism of period functions - cohomology-free proof*

Maass cusp forms (certain eigenfunctions of the Laplace operator) on hyperbolic surfaces have many applications in mathematics, physics, and other fields. For suitable hyperbolic surfaces $\Gamma\backslash\mathbb{H}$, Maass cusp forms can be characterized using eigenfunctions of transfer operators, the so-called period functions for Γ. Based on Selberg theory and cohomology theory, it is expected that this relationship also holds in the presence of certain representations of Γ. Furthermore, it is expected that there is a close correlation between the corresponding period functions of suitable pairs of different areas and representations. However, this correlation is not yet understood.

We consider the situation of $\Gamma = \mathrm{PSL}_2(\mathbb{Z})$, $\Lambda = \mathrm{P}\Gamma_0(2)$ (Hecke congruence subgroup of level 2) and the induced representation χ of Λ on Γ. We present an explicit isomorphism between certain period functions of (Γ, χ) and Λ, which is independent of Selberg theory and cohomology theory. The structure of this proof suggests that such results also hold for other groups. We give an outlook for similar connections for projective Hecke congruence subgroups of prime level.

Rashi Lunia: *Extreme values of L-functions*

In 2008, Soundararajan introduced the resonance method and showed the existence of a normalized Hecke eigenform f of weight k and level one such that

$$L(1/2, f) \;\geq\; \exp\left((1+o(1))\sqrt{\frac{2\log k}{\log\log k}}\right)$$

for sufficiently large $k \equiv 0 \pmod 4$. In this talk, we will discuss a recent work with Sanoli Gun, where we study how often $L(s, f)$ attains large values at $s = 1/2$. We further investigate this question for L-functions attached to quadratic twists of f. Finally we give applications of our results to the theory of half-integer weight modular forms.

Oana Padurariu: *Bielliptic Shimura curves $X_0^D(N)$ with nontrivial level*

I explain how we work towards completely classifying all bielliptic Shimura curves $X_0^D(N)$ with nontrivial level N, extending a result of Rotger that provided such a classification for level one. This allows us to determine the list of all pairs (D, N) for which $X_0^D(N)$ has infinitely many degree two points. This is joint work with Frederick Saia.

Swati:

Explicit images for the Shimura Correspondence

Abstract

For $(r, 6) = 1$ with $1 \leq r \leq 23$, and a non-negative integer s, we define

$$\mathcal{A}_{r,s,N,\chi} = \{\eta(z)^r f(z) : f(z) \in M_s(N, \chi)\}.$$

In 2014, Yang showed that for $F \in \mathcal{A}_{r,s,1,1_N}$, the r-th Shimura image associated to the theta-multiplier $\mathrm{Sh}_r(F \mid V_{24}) = G \otimes \chi_{12}$ where $G \in S^{new}_{r+2s-1}\left(6, -\left(\frac{8}{r}\right), -\left(\frac{12}{r}\right)\right)$. He proved a similar result for $(r, 6) = 3$. His proofs rely on trace computations in integral and half-integral weights.

In this talk, we provide a constructive proof of Yang's result. We obtain explicit formulas for $\mathcal{S}_r(F)$, the r-th Shimura lift associated to the eta-multiplier defined by Ahlgren, Andersen, and Dicks, when $1 \leq r \leq 23$ is odd and $N = 1$. We also obtain formulas for lifts of Hecke eigenforms multiplied by theta-function eta-quotients and lifts of Rankin-Cohen brackets of Hecke eigenforms with theta-function eta-quotients. This is a joint work with Matthew Boylan.

Naomi Tanabe: *Subconvexity for L-functions of Hilbert modular forms*

The bound $\zeta(1/2+it) \ll (1+|t|)^{1/4+\epsilon}$ is known as the convexity bound, which is a consequence of standard analytic properties. Achieving stronger bounds, so-called *subconvexity bounds*, is a challenging problem and remains one of the central topics in analytic number theory. This talk will begin by surveying key developments in the subconvexity problem for various L-functions, and then focus on ongoing joint work with Keshav Aggarwal, which aims to establish a subconvexity bound in the setting of totally real number fields.

5 City tour

If you have time to spend in the city, there is a bunch of nice museums, houses, churches, and other sightseeing opportunities. Some suggestions are here:

https://www.bremen.eu/tourism/activities/48-hours-in-bremen-day-one

In addition, Bremen Tourism offers a free audio guide in different languages for a city tour of about 1.5–2 hours. The restaurant Luv is near Nr. 10. Here you find the tour and the guide:

https://www.bremen.eu/tourism/activities/audio-guides/free-audioguide-historic-city-centre#/

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7 Poster

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Please register: http://unihb.eu/wiaf2025

Organizers:

Claudia Alfes, Anna von Pippich, Anke Pohl

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