
Women in Arithmetic Geometry

Heidelberg, September 26 - 30, 2022

Organizers

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Photo on frontpage: "Universität Heidelberg - Kommunikation und Marketing"

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Acknowledgements

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**UNIVERSITÄT
HEIDELBERG**
ZUKUNFT
SEIT 1386



LOEWE

Exzellente Forschung für
Hessens Zukunft

1 Program

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00 -Registration-		9:00	9:30	9:00
10:00 Fintzen	9:30 Alfes-Neumann	García	Fruttidoro	Newton
11:30 Kezuka	11:00 Lin	10:30 Wiersema	11:00 Romano	10:30 Vignéras
15:15 Zhang	15:00 Ravi	11:45 Fust	15:00 Esnault	11:45 Cadoret
16:45 Santos	16:30 Pauli	-Excursion-	16:30 Mavraki	
18:30 -Get Together-		-Excursion-	19:00 -Conference Dinner-	

Each talk is 60 minutes long.

All talks take place in “Im Neuenheimer Feld 205”, room “Hörsaal”. It is the building 6205 on the map in §5.

The coffee breaks between the talks take place in the common room.

In §3.2 you find many lunch and dinner options.

2 Abstracts

Claudia Alfes-Neumann: Harmonic Maass forms in number theory and geometry

In this talk we give a short overview about the theory of harmonic (weak) Maass forms and some applications in number theory and (arithmetic) geometry. First, we will briefly describe how the study of generating series of number theoretic functions is related to modular forms. Then we will introduce harmonic weak Maass forms, real-analytic generalizations of modular forms. We will focus on half-integral weight harmonic weak Maass forms and explain how theta lifts can be used to describe their coefficients in terms of periods. This description can be used to relate the vanishing of the central L -derivative of rational elliptic curves to the rationality of the Fourier coefficients of such harmonic weak Maass forms.

Anna Cadoret: On the sparsity of toric points for p -adic local systems arising from geometry

Let X be a smooth, separated, geometrically connected variety over a number field k and $(F_p)_p$ a compatible family of p -adic local systems arising from geometry on X . The Mumford-Tate conjecture and the generalized André-Oort conjecture (Klingler) predict that the set of toric points of bounded degree for F_p is independent of p and not Zariski-dense in X . We show unconditionnally that, at least for an infinite set of primes p (actually of density 1 under a mild assumption) the set of k -rational toric points for F_p is not Zariski-dense in X . The proof uses among other things an enhanced construction due to Betts and Stix of the p -adic period map introduced by Lawrence and Venkatesh. This is a joint work with Jakob Stix.

Hélène Esnault: Not all rigid local systems are cohomologically rigid

We will define those two notions, show they are not equivalent (joint with Johan de Jong and Michael Groechenig, 2022), and recall that this means that Simpson's integrality conjecture is open in general.

Jessica Fintzen: Representations of p -adic groups

The Langlands program is a far-reaching collection of conjectures that relate different areas of mathematics including number theory and representation theory. A fundamental problem on the representation theory side of the Langlands program is the construction of all (irreducible, smooth, complex) representations of p -adic groups.

I will provide an overview of our understanding of the representations of p -adic groups, with an emphasis on recent progress.

I will also outline how results about the representation theory of p -adic groups can be used to obtain congruences between arbitrary automorphic forms and automorphic forms which are supercuspidal at p , which is joint work with Sug Woo Shin. This simplifies earlier constructions of attaching Galois representations to automorphic representations, i.e. the global Langlands correspondence, for general linear groups. Moreover, our results apply to general p -adic groups and have therefore the potential to become widely applicable beyond the case of the general linear group.

Martina Fruttidoro: Non-regular trianguline representations

Trianguline representations are a certain type of p -adic Galois representations which arose in the framework of the p -adic local Langlands and their definition is strictly connected to the notion of overconvergent (ϕ, Γ) -modules. Roughly speaking, trianguline representations correspond to Galois-equivariant vector bundles on the Fargues-Fontaine curve that admit a full (Galois stable) flag. In 2014 Eugen Hellmann and Benjamin Schraen constructed the “trianguline variety”, a rigid space whose points are trianguline representations. In this talk we will discuss properties of this space at certain non-regular parameters, and we will link the construction of the space to a more conceptual construction using the stack of all equivariant vector bundles with a B -structure, where B is the Borel of upper triangular matrices in GL_d .

Paulina Fust: Continuous group cohomology and Ext-groups
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We prove that the continuous cohomology groups of a p -adic reductive group with coefficients in an admissible unitary \mathbb{Q}_p -Banach space representation Π are finite-dimensional and compare them to certain Ext-groups. As an application of this result, we show that the continuous cohomology of $SL_2(\mathbb{Q}_p)$ with values in non-ordinary irreducible \mathbb{Q}_p -Banach space representations of $GL_2(\mathbb{Q}_p)$ vanishes.

Yukako Kezuka: Non-vanishing theorems for elliptic curves with complex multiplication

The arithmetic of elliptic curves with complex multiplication has attracted many mathematicians, especially in the context of the Birch-Swinnerton-Dyer conjecture. Amongst these curves, Gross has introduced a particularly nice elliptic curve with complex multiplication. Using Iwasawa theory, I will prove non-vanishing theorems for the central values of the complex L -series of a large class of quadratic twists of the Gross elliptic curve. In particular, we obtain the finiteness of the Tate-Shafarevich group for these curves. This is joint work with Yong-Xiong Li.

Jie Lin: Deligne's conjecture for automorphic motives

In this talk, we will first introduce a conjecture of Deligne on special values of L -functions. This conjecture generalizes the famous result by Euler on the Riemann-zeta values at positive even integers, and predicts a relation between motivic L -values and geometric periods. We will then explain an approach towards this conjecture for automorphic motives and summarize some recent progress (joint with H. Grobner and M. Harris).

Elisa García: Lower bounds on the maximal number of rational points on curves over finite fields (joint work with Jonas Bergström, Everett W. Howe, and Christophe Ritzenthaler)

For a given genus $g \geq 1$, we give lower bounds for the maximal number of rational points on a smooth projective absolutely irreducible curve of genus g over \mathbb{F}_q . As a consequence of Katz-Sarnak theory, we first get for any given $g > 0$, any $\epsilon > 0$ and all q large enough, the existence of a curve of genus g over \mathbb{F}_q with at least $1 + q + (2g - \epsilon)\sqrt{q}$ rational points. Then using sums of powers of traces of Frobenius of hyperelliptic curves, we get a lower bound of the form $1 + q + 1.71\sqrt{q}$ valid for $g \geq 3$ and odd $q \geq 11$. Finally, explicit constructions of towers of curves improve this result, with a bound of the form $1 + q + 4\sqrt{q} - 32$ valid for all $g \geq 2$ and for all q .

Myrto Mavraki: Dynamical variants of the Bogomolov conjecture

Inspired by an analogy between torsion and preperiodic points, Zhang has proposed a dynamical generalization of the classical Manin-Mumford and Bogomolov conjectures. A special case of these conjectures, for ‘split’ maps, has recently been established by Nguyen, Ghioca and Ye. In particular, they show that two rational maps have at most finitely many common preperiodic points, unless they are ‘related’. In this talk we discuss uniform as well as ‘relative’ versions of the dynamical Bogomolov conjecture across families of split maps. This is joint work with Harry Schmidt (University of Basel).

Rachel Newton: Evaluating the wild Brauer group

The local-global approach to the study of rational points on varieties over number fields begins by embedding the set of rational points on a variety X into the set of its adelic points. The Brauer-Manin pairing cuts out a subset of the adelic points, called the Brauer-Manin set, that contains the rational points. If the set of adelic points is non-empty but the Brauer-Manin set is empty then we say there’s a Brauer-Manin obstruction to the existence of rational points on X . Computing the Brauer-Manin pairing involves evaluating elements of the Brauer group of X at local points. If an element of the Brauer group has order coprime to p , then its evaluation at a p -adic point factors via reduction of the point modulo p . For p -torsion elements this is no longer the case: in order to compute the evaluation map one must know the point to a higher p -adic precision. Classifying p -torsion Brauer group elements according to the precision required to evaluate them at p -adic points gives a filtration which we describe using work of Bloch and Kato. Applications of our work include addressing Swinnerton-Dyer’s question about which places can play a role in the Brauer-Manin obstruction. This is joint work with Martin Bright.

Sabrina Pauli: Arithmetic enrichments of classical results in enumerative geometry

In a groundbreaking paper Jesse Kass and Kirsten Wickelgren gave an arithmetic enrichment of the classical count of complex lines on a smooth cubic surface, that is, they explained how to count these lines over an arbitrary base field. Since then their methods have been used to arithmetically enrich many other classical results in enumerative geometry. In my talk I will explain how these arithmetic enrichments work and give some examples.

Charanya Ravi: Equivariant localization theorem for algebraic stacks

The classical Atiyah-Bott localization theorem in equivariant singular cohomology for spaces with torus action is one of the main computational tools in enumerative geometry. The need to access general parameter spaces (singular and stacky) and the need for refined counts (in other cohomology theories) motivates the need for a more general localization theorem. In this talk, based on recent joint work with Dhyan Aranha, Adeel Khan, Alexei Latyntsev and Hyeonjun Park, we will discuss such a unified Atiyah-Bott localization theorem for equivariant cohomology theories of algebraic stacks.

Beth Romano: A Fourier transform for unipotent representations of p -adic groups

Representations of finite reductive groups have a rich structure, first explored by Deligne–Lusztig. In joint work with Anne-Marie Aubert and Dan Ciubotaru, we show a way to lift some of this structure to representations of p -adic groups. In particular, we work with unipotent representations of split p -adic groups and their inner twists. We consider the relation between Lusztig’s nonabelian Fourier transform and a certain involution we define on the level of p -adic groups. This talk will be an introduction to the topic with a focus on examples.

Mafalda Santos: Vanishing of mod ℓ cohomology for PEL-type A Shimura varieties

In the previous work of Caraiani and Scholze, they prove that torsion cohomology of compact unitary Shimura varieties with mod ℓ coefficients is concentrated in middle degree under a genericity assumption at an auxiliary prime p . Later on, they were able to extend this result to some even unitary groups and their associated non-compact Shimura varieties. More recently, Koshikawa introduced a different and much more versatile method for proving this kind of result, which he used to extend their results, particularly in the compact case. In this talk, we will discuss a further generalization of the results of Caraiani-Scholze and Koshikawa to arbitrary unitary Shimura varieties.

Marie-France Vignéras: Questions on representations of reductive p -adic groups and of Hecke algebras over a commutative ring R

I will discuss questions (admissibility and Gelfand-Kirillov dimension) on representations of reductive p -adic groups and on Hecke algebras modules raised in our paper for the 2022-I.C.M. Noether lecture.

Hanneke Wiersema: Modularity in the partial weight one case

The strong form of Serre's conjecture states that a two-dimensional mod p representation of the absolute Galois group of \mathbb{Q} arises from a modular form of a specific weight, level and character. Serre considered modular forms of weight at least 2, but in 1992 Edixhoven refined this conjecture to include weight one modular forms. In this talk we discuss analogues of Edixhoven's refinement for Galois representations of totally real fields, extending recent work of Diamond–Sasaki.

Mingjia Zhang: A PEL-type Igusa stack and its compactification

In this talk I'll explain the construction of a small v-stack that interpolates Igusa varieties for a given PEL-type Shimura data, and a strategy towards its compactification. This is a geometric version of Mantovan's product formula, which helps to compute the étale cohomology of the corresponding Shimura varieties.

3 General Information

3.1 Lecture Hall

All talks will take place in the “Hörsaal”, Mathematikon Building. The address of the building is “Im Neuenheimer Feld 205”.

3.2 Restaurants

The university cafeteria “Mensa” offers a good variety of inexpensive meals for lunch, including buffet, address “Im Neuenheimer Feld 304”, Monday to Friday 11:15 to 14:00. Additionally, the bistro “Café Botanik”, located in the same building, is open 09:00 to 20:00. Furthermore, there are lots of good restaurants and bistros in the Old Town. If you would like to make reservations, please dial 0049 6221 preceding the number given below.

Name	Address	Phone	Cuisine
Goldener Anker	Untere Neckarstr. 52	167444	Mediterranean
Palmbräu Gasse	Hauptstr. 185	28536	German
Vetter’s Alt	Steingasse 9	165850	German
Raja Rani	Friedrichstr. 15,	6530893	Indian
Saigon Sonne	Hauptstr. 170	6596999	Vietnamese
Phuket Thai	Steingasse 1	6524003	Thai
Joe Molese	Steingasse 16a	6548952	American
Kilimanjaro	Dreikönigstr. 6	7293939	Eritrean
La Bruschetta	Plöck 56	189909	Italian
da Mario	Rohrbacher Str. 3	183591	Italian
Choa	Zwingerstr. 20	7288106	Asian & Sushi
Cafe Extrablatt	Hauptstr. 53	8935340	International

3.3 Nightlife

As a student city Heidelberg has some decent bars and offers possibilities for late night activities.

Name	Address	Description
The Dubliner	Hauptstr. 93	Irish pub
Palmbräu Gasse	Hauptstr. 185	Beer and other drinks
La Fee	Untere Strasse 29	Cocktails
Sonderbar	Untere Straße 13	Cocktails, Whisky etc.
Destille	Untere Str. 16	Beer, Shots etc.
Eckstein	Fischmarkt 3	Beer, Shots, Longdrinks

3.4 WiFi

Eduroam is available on the campus of the Heidelberg University. Alternatively, you have access to the UNI-WEBACCESS WiFi, note however that this is un-encrypted.

3.5 Get together

On Monday at 6:30pm, we will have a “get together” at the common room in the Mathematikon.

3.6 Excursion to the Königsstuhl

On Wednesday afternoon, we will go on a hike to the Königsstuhl. The starting time will be between 2pm and 3pm, depending on the weather. We will return around 6pm. In between, around 4pm, we will have coffee and cake at Berggasthof Königsstuhl (Address: Königsstuhl 2, 69117 Heidelberg).

3.7 Conference Dinner

On Thursday at 7pm, the conference dinner will take place at Kulturbrauerei (Address: Leyergasse 6, 69117 Heidelberg). There will be a choice between two set menus (one of them is vegetarian).

3.8 Contact Information

If there are any questions concerning the workshop, please feel free to contact either one of the organizers or our secretaries:

- Brigitte Apfel
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4 Participants

Raghda Abdellatif: Humbolt Universität zu Berlin
Eleni Agathocleous: CISP A Helmholtz Center for Information Security
Claudia Alfes-Neumann: Universität Bielefeld
Mabud Ali Sarkar: The University of Burdwan
Swati Antal: Army Cadet College Wing, IMA Dehradun
Ngu Elarine Atuh: The University of Buea
Ayreena Bakhtawar: University of New South Wales, Sydney
Ashima Bansal: Indian Institute Of Science Education And Research
Debmalya Basak: University of Illinois
Hayat Bensella: USTHB Algeria
Patrick Bieker: TU Darmstadt
Manuel Blickle: JGU Mainz
Kaj taz Bllaca: University of Prishtina
Gebhard Böckle: Universität Heidelberg
Jakob Burgi: Universität Heidelberg
Anna Cadoret: Sorbonne Université
Jiaming Chen: Goethe University Frankfurt
Rizacan Ciloglu: TU Darmstadt
Christian Dahlhausen: Universität Heidelberg
Sampa Dey: Indian Statistical Institute, Kolkata
Jaro Eichler: Goethe University Frankfurt
Brahim El Alaoui: Mohammed V University Rabat
Hadeer Elhemaily: British university
Hélène Esnault: Freie Universität Berlin
Daniel Fink: JGU Mainz
Jessica Fintzen: Universität Bonn
Janne Frenz: Universität Heidelberg

Linda Frey: Universität Göttingen
Martina Fruttidoro: Universität Münster
Holly Green: University College London
Shai Haran: Technion - Israel institute of technology
Lukas Heger: Heidelberg University
Manuel Hoff: University Duisburg-Essen
Tim Holzschuh: Heidelberg University
Patrick Ingram: York University
Konstantin Jakob: TU Darmstadt
Changho Keem: Seoul National University
Yukako Kezuka: Max Planck Institute for Mathematics
Mohammed Saqlain Khan: Universität Bonn
Agrawal Khushi: DePaul University
Paul Kiefer: TU Darmstadt
Seoyoung Kim: Queen's University / University of Göttingen
Lars Kleinemeier: Bielefeld University
Mohamed Amine Koubaa: Heidelberg University
Marius Leonhardt: Universität Heidelberg
Yingkun Li: TU Darmstadt
Jie Lin: Universität Duisburg-Essen
Remi Lodh: Springer
Elisa Lorenzo García: Université de Neuchâtel
Judith Ludwig: University of Heidelberg
Catrin Mair: TU Darmstadt
Milan Malcic: Universität Heidelberg
Myrto Mavraki: Harvard University
Sarah Diana Meier: Universität Bielefeld
Mafalda Milheiro Marques da Silva Santos: Imperial College London
Katharina Müller: Université Laval

Rachel Newton: King's College London
Loc Nguyen: Loc Nguyen's Academic Network
Sabrina Pauli: Universität Duisburg-Essen
Charanya Ravi: Max Planck Institute for Mathematics
Timo Richarz: Technische Universität Darmstadt
Christina Röhrig: TU Darmstadt
Beth Romano: King's College London
Nermin Saber: British university in Egypt
Khadidja Sabri: University of Oran
Jayashree Saha: Techno India Group Public School
Neelam Saikia: University of Vienna
Narges Shavali Kohshor: Kharazmi university
Alireza Shavali Kohshor: Universität Heidelberg
Valentina Sinaj: Tirana University
Mahinshi Singla: Jawaharlal Nehru University
Jakob Stix: Goethe Universität Frankfurt
Vaidehee Thatte: (King's College London
Anita Tomar: Sri Dev Suman Uttarakhand University
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Hanneke Wiersema: University of Cambridge
Can Yaylali: TU Darmstadt
Mingjia Zhang: Universität Bonn

5 Campus map

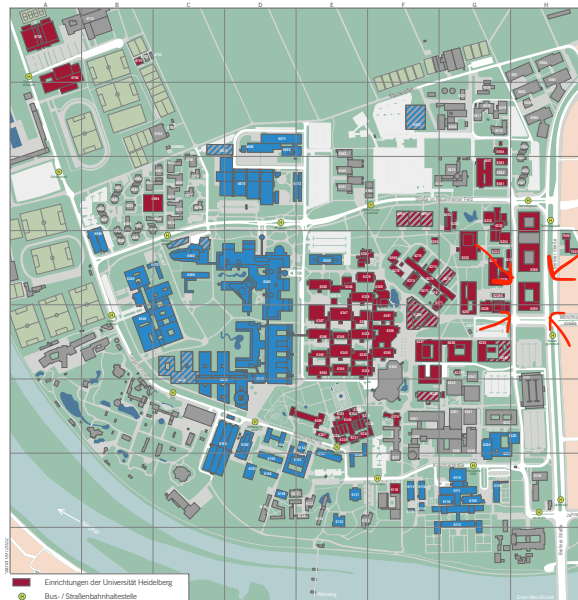


Figure 5.1: Map of the “Neuenheimer Feld” campus