

p -adic modular forms and Galois representations

University of Sheffield

15-19 July 2019



**The
University
Of
Sheffield.**

	Monday	Tuesday	Wednesday	Thursday	Friday
9.00-10.00	-	T.Gee	J.Newton	J.Tilouine	C.Williams
10.00-10.30	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
10.30-11.30	H.Hida	V.Pilloni	J.Thorne	K.Klosin	Z.Liu
11.45-12.45	-	-	D.Benois	-	E.Lecouturier
12.45-13.45	Lunch	Lunch	Lunch	Lunch	
13.45-14.45	T.Bouganis	P. van Hoften A. Maksoud A. Iyengar	Peak District	V.Hernandez	
15.00-16.00	C.W.Erickson	G.Boxer	Excursion	S.Hattori	
16.00-16.30	Coffee break	Coffee break		Coffee break	
16.30-17.30	M.Dimitrov	L.Dembélé		A.Pozzi	
17.40-18.00	A.Weiss				
19.00				Conf dinner	

Location

All talks will take place in the Hick's Building, 226 Hounsfield Road, S3 7RH.

The talks will take place in LT6 (E floor). Registration and coffee breaks will be in I19 (I floor).

Lunch options

- **The University Arms**, 197 Brook Hill. A pub, about a 3 minute walk from the Hick's Building. Vegetarian and vegan options. Some tables have been reserved for conference participants for lunch on Monday and Tuesday. \$\$
- **The Interval Cafe and Bar**: located in the University of Sheffield Students' Union, serves pizzas, soups, hot and cold sandwiches, hot main courses. Vegetarian, vegan and Halal options. \$
- **California Fresh**, 257 Glossop Road. About a 5 minute walk from the Hick's Building. Mexican-style food. Vegetarian and vegan options. \$
- **Orient Express**, 290 Glossop Road. About a 5 minute walk from the Hick's Building. Cantonese/Sichuan food. Vegetarian and vegan options. \$\$
- **Upshot Espresso**, 355 Glossop Road. About a 5 minute walk from the Hick's Building. Cafe serving British/European food. Vegetarian and vegan options. \$\$

Excursion

On Wednesday after lunch we planned a walk in the Peak District. We will meet at the Gell Street bus stop on Glossop Road (opposite the pharmacy) at 14:40 (to take the 271 bus towards Castleton). Please bring some cash for the bus, wear sturdy shoes, and bring a waterproof jacket and bottle of water. We are planning a 2.5 hour walk first over moorland with interesting rock formations and lovely views of the Hope Valley, then down through Padley Gorge with its ancient woodland and many waterfalls. We will end by walking through Longshaw Estate and stopping at the Fox House (where food and drink can be purchased). The 272 bus returns from there at either 18:36 or 19:36.

Conference Dinner

The conference dinner will be at **7pm on Thursday** at

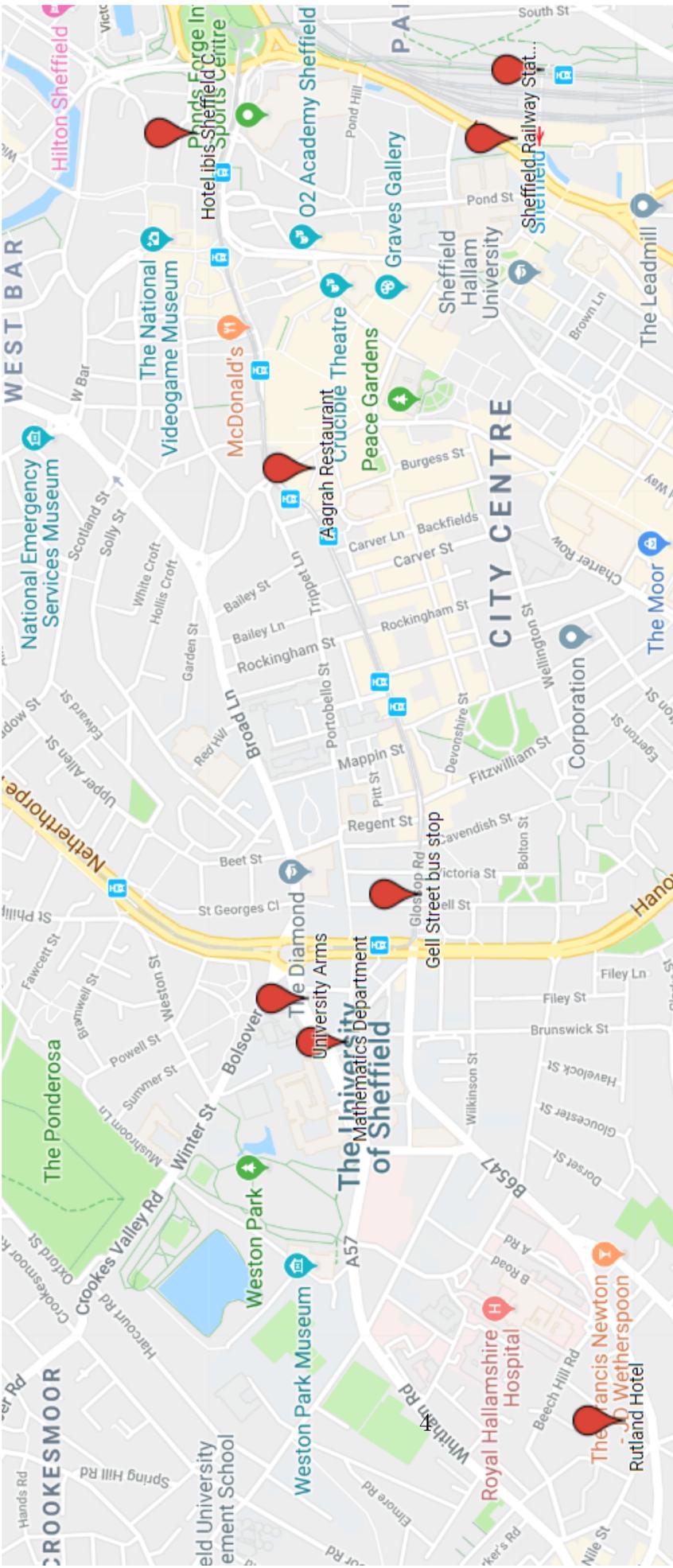
Aagrah Kashmiri Restaurant

1 Leopold St
Sheffield S1 2JG.

The meal is included in the registration fee, however our funding restrictions mean that we can't pay for alcohol.

Organisers

The organisers are Tobias Berger and Adel Betina. Please come and find us if you need anything!



Titles and Abstracts

Extra-zeros of Rankin-Selberg p -adic L -functions

Denis Benois

Université Bordeaux

We discuss extra-zeros of p -adic L -functions of motives having good reduction at p . An archetypical example is provided by the Kubota–Leopoldt L -function associated to a character χ such that $\chi(p) = 1$ and the theorem of Ferrero and Greenberg. Other interesting examples arise from some modular forms of odd weight. In this situation, the special value of the p -adic L -function can be expressed in terms of an L -invariant defined using p -adic Hodge theory. In both cases, trivial zeros appear in a critical point. In this talk, we are mainly interested in the non-critical case. The basic example we have in mind is provided by the Rankin-Selberg convolution of two modular forms of the same weight (joint work with S. Horte).

Quaternionic modular forms and the Rankin-Selberg method

Athanasios Bouganis

Durham University

The algebraic and p -adic properties of special L -values of Siegel and Hermitian modular forms are of central interest and have been extensively studied. In this talk, we will discuss another family of modular forms, which are associated to the isometry group of a quaternionic skew hermitian form. We will present some recent progress on the study of their standard L -function using the Rankin-Selberg method. This will lead us to discuss the existence of some theta series, a problem of which, in turn, is related to Howe duality and invariant theory.

Higher Hida theory for Hilbert modular varieties in regular weight

George Boxer

University of Chicago

The goal of Higher Hida theory is to understand the “ordinary part” of higher coherent cohomology of Shimura varieties. In this talk I will define this ordinary part in the case of Hilbert modular varieties, and explain what we know about it. This is joint work in progress with Vincent Pilloni.

Abelian varieties with everywhere good reduction over certain real quadratic fields with small discriminant

Lassina Dembélé

Dartmouth College

Let $F = \mathbb{Q}(\sqrt{D})$, where $D = 53, 61$ or 73 . There is a simple abelian surface A/F with everywhere good reduction. In this talk, we explain that, under GRH, every abelian variety with everywhere good reduction defined over F is isogenous to a power of A . This result extends previous work of Fontaine and Schoof.

Uniform irreducibility of Galois action on the ℓ -primary part of Abelian 3-folds of Picard type

Mladen Dimitrov

Université Lille

Half a century ago Manin proved a uniform version of Serre’s celebrated result on the openness of the Galois image in the automorphisms of the ℓ -adic Tate module of any non-CM elliptic curve over a given number field. Recently in a series of papers Cadoret and Tamagawa established a definitive result regarding the uniform boundedness of the ℓ -primary torsion for 1-dimensional abelian families. In a collaboration with D. Ramakrishnan we provide first evidence in higher dimension, in the case of abelian families parametrized by Picard modular surfaces over an imaginary quadratic field M . Namely, we establish a uniform irreducibility of Galois acting on the ℓ -primary part of principally polarized Abelian 3-folds with multiplication by M , but without CM factors.

Moduli stacks of Galois representations

Toby Gee

Imperial College London

I will discuss the construction and some basic properties of moduli stacks of Galois representations. This is joint work with Matthew Emerton.

\wp -adic continuous families of Drinfeld eigenforms of finite slope

Shin Hattori

Tokyo City University

Let p be a rational prime and $q > 1$ a p -power integer. Drinfeld modular forms are rigid analytic functions on the Drinfeld upper half plane over $\mathbb{F}_q((1/t))$ satisfying a similar transformation condition and holomorphy condition to elliptic modular forms. Though numerical computations suggest that they have interesting \wp -adic structures, we still have poor understanding of them. In this talk, I will explain how to construct \wp -adic continuous families of Drinfeld eigenforms of finite slope using Teitelbaum's description of Drinfeld cuspforms via the Steinberg module, and also what we can say about slope zero Drinfeld cuspforms.

Families of automorphic forms for general PEL Shimura varieties

Valentin Hernandez

Université Paris-Sud

Families of automorphic forms have proven to be a great tool in number theory in the past 30 years. To construct such families, we can use coherent cohomology and the theory of the canonical subgroup. Unfortunately, for some primes, Shimura varieties can have an empty ordinary locus and thus no canonical subgroup ! In this talk I would like to explain how we can use the rigid and integral geometry of Shimura varieties with higher level at p to bypass these difficulties. If time permits, I will try to explain some number theoretic applications.

Adjoint Selmer groups and cyclicity

Haruzo Hida

UCLA

For a given elliptic cusp form f , we have a 2-dimensional p -adic Galois representation r with coefficients in a p -adic integer ring. Having r act on $\mathrm{SL}(2)$ -Lie algebra by adjoint (conjugate action), we get a 3-dimensional representation Ad . We describe the formula of the order of the p -adic arithmetic cohomology group $\mathrm{Sel}(\mathrm{Ad})$ (called the adjoint Selmer group) via the L-value $L(1, \mathrm{Ad}) = L(1, \mathrm{Ad}(f))$ and explore the question when the Selmer group is cyclic (having one generator) over the coefficient ring?

A geometric Jacquet-Langlands correspondence for paramodular Siegel threefolds

Pol van Hoften

King's College London

PhD
student
talk

It is an old idea of Serre that the classical Jacquet-Langlands correspondence between modular forms and quaternion modular forms can be realised geometrically. In this talk I will discuss an extension of these ideas to Siegel modular forms of genus two and paramodular level. We use this to prove the weight-monodromy conjecture for the Siegel threefold of paramodular level. Moreover we construct a geometric Jacquet-Langlands correspondence between GSp_4 and a 'definite' inner form, proving a conjecture of Ibukiyama.

Irreducible components of Galois deformation spaces

Ashwin Iyengar

King's College London

PhD
student
talk

Let K be a finite extension of \mathbb{Q}_p . We classify the irreducible components of the generic fiber of the universal deformation space of the trivial n -dimensional $\mathrm{Gal}(\overline{K}/K)$ -representation valued in a finite field of characteristic p , under the assumption that $p > n$. We also show that under this assumption, the crystalline points are Zariski-dense in the generic fiber.

The Paramodular Conjecture for abelian surfaces with rational torsion

Krzysztof Klosin

CUNY Queens College

The Paramodular Conjecture can be viewed as an analog of the Taniyama-Shimura Conjecture for abelian surfaces asserting that they should correspond to certain (paramodular) Siegel modular forms. We will discuss recent progress on the conjecture and focus on the situation when the abelian surface has a rational torsion point. We will present a method that allows one to verify the conjecture in new cases. This is joint work with T. Berger.

Mazur's Eisenstein ideal, Sharifi's conjecture and Mazur-Tate's conjecture

Emmanuel Lecouturier

Tsinghua University

In 1987, Barry Mazur and John Tate formulated refined conjectures of the “Birch and Swinnerton-Dyer type”, and one of these conjectures was essentially proved in the prime conductor case by Ehud de Shalit in 1995. One of the main objects in de Shalit's work is the so-called refined L-invariant, which happens to be a Hecke operator. We consider the problem of determining to which power of the Eisenstein ideal the L-invariant belongs. We give a partial answer to this problem by making use of results of Jun Wang on a conjecture of Romyar Sharifi concerning Eisenstein ideals of level $\Gamma_1(N)$.

p -adic L-functions and doubling archimedean zeta integrals for symplectic groups

Zheng Liu

McGill University

In order to prove the desired interpolation properties of the p -adic standard L-functions for Siegel modular forms, one needs to calculate a doubling archimedean zeta integral for holomorphic discrete series on $\mathrm{Sp}(2n, \mathbb{R})$. When the holomorphic discrete series is of scalar weight, it has been computed by Bocherer-Schmidt and Shimura. I will explain a way to compute this archimedean zeta integral for general vector weight by using the theory of theta correspondence, and verify that the results are compatible with the conjecture of Coates-Perrin-Riou.

Iwasawa theory for weight one modular forms

PhD
student
talk

Alexandre Maksoud

Université Lille

We formulate an Iwasawa Main Conjecture for classical weight one modular forms, and we give strong evidence in favour of this conjecture. Our results rely on a detailed study of the structure of various Selmer groups and on the smoothness of the Eigencurve at classical weight one points.

Vanishing of adjoint Selmer groups

James Newton

King's College London

I will discuss some results on the vanishing of adjoint Selmer groups for (polarized) automorphic Galois representations. This is joint work in progress with Jack Thorne, motivated by an application to automorphy of symmetric powers of modular forms (see Jack's talk). The main novelty is that we do not impose any assumptions on the residual image of the representation (it can even be trivial).

Hecke operators and the coherent cohomology of Shimura varieties.

Vincent Pilloni

ENS Lyon

We discuss the problem of defining Hecke operators on the integral coherent cohomology of Shimura varieties. There are applications to Higher Hida theory (next talk by G. Boxer) and p -adic estimates for Satake parameters of certain self dual non-regular automorphic forms. This is joint work with N. Fakhruddin and G. Boxer.

Rigid meromorphic cocycles at real multiplication points

Alice Pozzi

University College London

A rigid meromorphic cocycle is a class in the first cohomology of the group $SL_2(\mathbb{Z}[1/p])$ acting on the non-zero rigid meromorphic functions on the Drinfeld p -adic upper half plane by Möbius transformation. Rigid meromorphic cocycles can be evaluated at points of real multiplication, and their RM values conjecturally lie in the ring class field of real quadratic fields, suggesting a striking analogy with the classical theory of complex multiplication. In this talk, we discuss a special case of the conjecture, relating the RM value of the “Eisenstein” Dedekind-Rademacher cocycle to a Gross-Stark unit. We explain the connection with certain deformations of Hilbert Eisenstein series of weight one. This is work in progress with Henri Darmon and Jan Vonk.

Symmetric power functoriality for $SL_2(\mathbb{Z})$

Jack Thorne

University of Cambridge

I will explain the proof, using eigenvarieties, that Ramanujan’s Δ function has infinitely many symmetric power liftings. This is joint work with Laurent Clozel and James Newton.

Congruences and adjoint Selmer groups for Bianchi modular forms

Jacques Tilouine

Paris 13

In a work in progress with E. Urban, we generalize results by Galatius-Venkatesh in order to relate the cohomology of a Bianchi threefold to the adjoint Selmer group of the Galois representation over the Hecke algebra. This Galois representation was constructed by Scholze and al.

Bi-ordinary modular forms

Carl Wang-Erickson

Imperial College London

It is well-understood that p -ordinary Hecke eigenforms give rise to global Galois representations which become reducible with an unramified quotient after restriction to a decomposition group at p . We present a construction of “bi-ordinary” p -adic modular forms. These are p -adic modular forms whose associated 2-dimensional Galois representations are not only p -ordinary, but also split as a sum of two characters upon restriction to a decomposition group at p . It is well-understood that p -ordinary eigenforms with complex multiplication (CM) give rise to such forms, but recent joint work with Francesc Castella indicates that there are non-CM bi-ordinary forms as well. This is also joint work with Francesc Castella.

Irreducibility of Galois representations associated to low weight Siegel modular forms

Ariel Weiss

University of Sheffield

If f is a cuspidal modular eigenform, Ribet proved that its associated p -adic Galois representation is irreducible for all primes p . More generally, it is conjectured that the p -adic Galois representations associated to cuspidal automorphic representations of $\mathrm{GL}(n)$ should always be irreducible.

In this talk, I will prove a version of this conjecture for low weight, genus 2 Siegel modular forms. These analogues of classical weight 1 modular forms are, conjecturally, the automorphic objects that correspond to abelian surfaces.

Parabolic eigenvarieties and p -adic L -functions for $\mathrm{GL}(2n)$

Chris Williams

Imperial College London

Let π be an automorphic representation of $\mathrm{GL}(2n)$ over a totally real field that admits a Shalika model (that is, it is a transfer from $\mathrm{GSpin}(2n+1)$). When π is ordinary at p , recent independent work of Gehrman and Dimitrov-Januszewski-Raghuram gives a p -adic L -function attached to π , that is, a p -adic measure interpolating its classical critical L -values. I will report on ongoing joint work with Daniel Barrera and Mladen Dimitrov where we generalise this to the non-ordinary case using overconvergent cohomology. We also vary this construction

PhD
student
talk

in p -adic families. Rather than standard overconvergent cohomology, defined with respect to the maximal torus in $\mathrm{GL}(2n)$, our results use a more flexible definition defined with respect to the subgroup $\mathrm{GL}(n) \times \mathrm{GL}(n)$, allowing weaker non-criticality conditions. In the process, we construct ‘parabolic eigenvarieties’ parametrising eigenpackets that are finite slope with respect to $\mathrm{diag}(p\mathrm{I}_n, \mathrm{I}_n)$ (rather than the full Hecke operator at p).

Participants

Geoffrey Akers, CUNY Graduate Center
Denis Benois, Université Bordeaux
Tobias Berger, University of Sheffield
Adel Betina, University of Sheffield
Thanasis Bouganis, Durham University
George Boxer, University of Chicago
Yichang Cai, Paris 13
Mariagiulia De-Maria, Université Lille
Lassina Dembélé, Dartmouth College
Mladen Dimitrov, Université Lille
Neil Dummigan, University of Sheffield
Dan Fretwell, University of Bristol
Toby Gee, Imperial College London
Andrew Graham, University College London
Shin Hattori, Tokyo City University
Valentin Hernandez, Université Paris-Sud
Ben Heuer, King's College London
Haruzo Hida, UCLA
Pol van Hoften, King's College London
Ashwin Iyengar, King's College London
Frazer Jarvis, University of Sheffield
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