Y-RANT 2022
Conference Booklet

VIA VERITAS VITA

Organisers:
Adam Morgan & Ross Paterson

Venue. The conference is being hosted at the Advanced Research Centre (ARC) at the University of Glasgow. The venue is very new (it opened this summer), but can now be found on Google maps, for example.

Conference Diner. The conference dinner will be held at 7pm on 24th August at Cottiers (Google maps link here), which is a 7 minute walk from the conference venue.

Travel. The ARC is very close to Kelvinhall subway station. If you wish to travel by train then the shortest routes are:

- Train to Glasgow Queen Street – Subway from Buchannan St. to Kelvinhall
- Train to Glasgow Central – Subway from St. Enoch Centre to Kelvinhall

The subway is one circuit, and so there is no "wrong line" for getting here; however the inner line will be the shorter route from the two train stations to Kelvinhall. Tickets are 'per journey', irrespective of the length of the journey, so you can ride around the circle for as many revolutions as you like. Times for first/final journeys are displayed at each subway station. See map below.
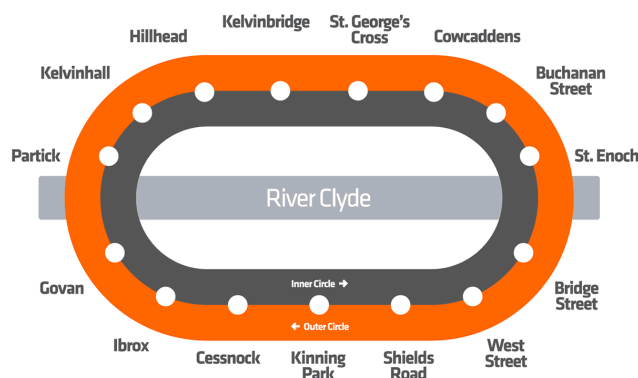
Food. There are many excellent cafés and restaurants further north on Byers road, which is the main road to the west of the ARC, as well as Dumbarton Road which is to the south.

Conference Schedule

Tuesday 23rd August		
09:30 – 10:30	**Registration**	
10:30 – 11:30	Plenary: Jessica Fintzen *Representations of p-adic groups*	
11:30 – 12:00	**Coffee Break**	
12:00 – 12:30	Hanneke Wiersema *Modularity in the partial weight one case*	Sam Streeter *Semi-integral points*
12:30 – 13:00	Bence Forrás *Integrality of smoothed p-adic Artin L-functions*	Otto Overkamp *Jacobians of geometrically reduced curves and their Néron models*
13:00 – 14:30	**Lunch Break**	
14:30 – 15:00	Johannes Girsch *The Doubling Method in Algebraic Families*	Mohamed Tawfik *Brauer-Manin obstructions on Kummer surfaces of products of CM elliptic curves*
15:00 – 15:30	Dominik Bullach *Cyclotomic units and the scarcity of Euler systems*	Alexandros Konstantinou *A quest for deriving local formulae*
15:30 – 16:00	**Coffee Break**	
16:00 – 16:30	Lorenzo La Porta *Generalised θ operators on some unitary Shimura varieties*	Jamie Bell p^{∞} – *Selmer ranks and Complex Multiplication*
16:30 – 17:00	Justin Trias *Towards an integral theta correspondence for type II dual pairs*	Steven Groen *p-torsion in characteristic p of Jacobians of Artin-Schreier curves*
17:00 – 17:30	Jesse Pajwani *The Massey Vanishing Conjecture*	Cameron Wilson *General Bilinear Forms over the Jacobi Symbol (and their application to rational point problems)*

Wednesday 24th August		
09:30 – 10:00	Jay Swar *Generalizing p-adic L-functions on moduli spaces of Galois representations*	Sunil Kumar Pasupulati *On the Existence of Euclidean ideal class in quartic, quadratic, and cubic extensions*
10:00 – 10:30	Guillem Tarrach *S-arithmetic cohomology and p-adic automorphic forms*	Art Waeterschoot *wild models of curves via nonarchimedean geometry*
10:30 – 11:00	Josh Pimm *Shimura Correspondences and Their Generalisations*	Yuan Yang *Is LMFDB wrong? A small story between me and LMFDB.*
11:00 – 11:30	**Coffee Break**	
11:30 – 12:00	Dmitri Whitmore *The Taylor–Wiles method for reductive groups*	Sadiah Zahoor *Congruences related to modular forms*
12:00 – 12:30	Sebastian Monnet *Parametrising number fields*	Siqi Yang *Computing weight one modular forms*
12:30 – 14:00	**Lunch Break**	
14:00 – 14:30	Lukas Kofler *A plectic Langlands-Rapoport conjecture*	Jenny Roberts *Newform Eisenstein congruences of local origin*
14:30 – 15:00	Martin Ortiz Ramirez *Prismatic F-crystals*	David Kurniadi Angdinata *Formalisation of elliptic curves in Lean*
15:00 – 15:30	Zeyu Liu *From de Rham prismatic crystals to nearly de Rham representations.*	Ashvni Narayanan *Formalisation of p-adic L-functions in Lean*
15:30 – 16:00	**Coffee Break**	
16:00 – 17:00	Plenary: James Newton *Modularity of elliptic curves over CM fields*	

Thursday 25th August		
09:00 – 09:30	Stevan Gajović *Reverse-engineered Diophantine equations*	Fabio Ferri *On reduction steps to Leopoldt's conjecture*
09:30 – 10:00	Katerina Santicola *Reverse Engineered Diophantine Equations over $\mathbb{Q}$*	Diego Chicharro *Multiple Zeta Values*
10:00 – 10:30	**Coffee Break**	
10:30 – 11:00	Harkaran Uppal *Hasse principle and cubic hypersurfaces.*	Andrew Pearce-Crump *The Generalised Shanks' Conjecture*
11:00 – 11:30	Robin Ammon *Cohen–Lenstra Heuristics: Distribution of Class Groups of Random Number Fields*	Josh Drewitt *Applications of real-analytic modular forms.*
11:30 – 12:00	**Coffee Break**	
12:00 – 12:30	Leonhard Hochfilzer *Diagonal Cubic Forms over $\mathbb{F}_q(t)$: Part I*	Sven Cats *Higher Descents on Elliptic Curves*
12:30 – 13:00	Jakob Glas *Diagonal Cubic Forms over $\mathbb{F}_q(t)$: Part II*	Elvira Lupoian *tba*
13:00 – 14:00	**Lunch Break**	
14:00 – 15:00	Plenary: Rachel Newton *Distribution of genus groups of abelian number fields*	

Jessica Fintzen

Representations of p-adic groups

Abstract: 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 representation theory of p-adic groups with a focus on recent developments. I will also briefly discuss applications to other areas.

James Newton

Modularity of elliptic curves over CM fields

Abstract: I will discuss some recent progress towards establishing modularity of elliptic curves over CM number fields (particularly imaginary quadratic fields). The new results I will talk about are joint work with Ana Caraiani.

Rachel Newton

Distribution of genus groups of abelian number fields

Abstract: Let K be a number field and let L/K be an abelian extension. The genus field of L/K is the largest extension of L which is unramified at all places of L and abelian as an extension of K. The genus group is its Galois group over L, which is a quotient of the class group of L, and the genus number is the size of the genus group. We study the distribution of genus numbers as one varies over abelian extensions L/K with fixed Galois group. This is joint work with Christopher Frei and Daniel Loughran.

Contributed Talks

Robin Ammon
Cohen–Lenstra Heuristics: Distribution of Class Groups of Random Number Fields

Abstract: The ideal class group of an algebraic number field captures a great deal of information about the arithmetic of the number field, making it a central object in algebraic number theory. Despite its great importance, however, not much is known about its structure in general. In order to shed some more light on the behaviour of class groups, H. Cohen and H. W. Lenstra Jr. studied their statistics in families of number fields, and building on their observations made influential conjectures about the distribution of class groups. These have later been extended and refined, but except for very few special cases remain unsolved to date. In this brief introduction to the Cohen–Lenstra heuristics, I will explain the ideas of arithmetic statistics behind the probabilistic approach to class groups, and will discuss the general principle for the distribution of random algebraic objects that underlies Cohen and Lenstra's at first curious seeming conjectures and which may eventually lead to a better understanding of class groups and related objects.

David Kurniadi Angdinata
Formalisation of elliptic curves in Lean

Abstract: Can a computer check the proof of Fermat's last theorem? Certainly, it needs to know the basics of modular curves to state the modularity theorem, and even then it has to arduously learn much of 20th century arithmetic geometry to get anywhere in Wiles' proof. In this talk, I will introduce the Lean theorem prover – a potential solution to this in the far future – and the components in its mathematical library relevant to algebraic number theory. I will also describe the ongoing attempt to formalise the arithmetic of elliptic curves to begin one side of the story.

Jamie Bell
p^∞ – Selmer ranks and Complex Multiplication

Abstract: The p^∞ – Selmer rank of an elliptic curve is a number related to the rank which is often easier to deal with than the rank itself. Using his work on the parity conjecture, Česnavičius proved in 2012 that for curves with complex multiplication (those with lots of endomorphisms), this is even. I will present an alternative proof, and discuss how it can be generalised to certain abelian varieties.

Dominik Bullach
Cyclotomic units and the scarcity of Euler systems

Abstract: Ever since their introduction, Euler systems have played an important role in spectacular advances in arithmetic geometry. In this talk, I will discuss Coleman's Conjecture (proved in recent joint work with Burns, Daoud, and Seo), which gives a precise description of the set of all classical Euler systems over the rationals. If time permits, I will also indicate striking consequences of these ideas towards the conjecture of Bloch and Kato over general number fields.

Sven Cats
Higher Descents on Elliptic Curves

Abstract: Computing the *n-Selmer group* of an elliptic curve E over the rational numbers $\mathbb{Q}$ gives an upper bound for the rank of $E(\mathbb{Q})$. The n-Selmer group parameterises isomorphism classes of *n-coverings* of E that are everywhere locally soluble; by an *explicit n-descent* we mean computing equations for such n-coverings. For certain applications, such as finding generators of large height for $E(\mathbb{Q})$, it is useful to be able to take n as large as possible. In this talk we discuss a way to achieve such higher descents: to combine an n- and an $(n+1)$-descent into an $n \cdot (n+1)$-descent.

Diego Chicharro
Multiple Zeta Values

Abstract: The values of the Riemann zeta function at even positive integers have been known to be rational multiples of powers of pi for a long time, but not so much is known for odd integers, although these special values seem to contain deep arithmetic information. Since generalisations usually lead to new insights, one can try to study a "multidimensional" version of the zeta function, thus getting a large family of special numbers called multiple zeta values. It turns out that these values satisfy many Q-linear relations, and conjecturally we know them all, but the proof of this remains out of reach. In this talk, we will discuss how these numbers are related to the geometry of the projective line minus three points, and explain how the "motivic" point of view allows us to prove partial results in that direction. Namely, we can bound below the number of linearly independent relations between MZVs by the number we expect.

Josh Drewitt
Applications of real-analytic modular forms.

Abstract: The space of real-analytic modular forms was recently introduced by Francis Brown. One reason this space is of great interest is because it contains or intersects various classes of important modular objects, such as classical modular forms, weakly anti-holomorphic forms and Maass wave forms. Therefore, the space of real-analytic modular forms can be viewed as a unifying tool for all these individual subspaces. The purpose of this talk is to introduce you to this space and to demonstrate a few of its interesting properties and applications. We give examples of real-analytic modular forms, discuss the period polynomials and L-functions related to this space, and see how these forms connect to the study of string theory in physics.

Fabio Ferri
On reduction steps to Leopoldt's conjecture

Abstract: Let p be a rational prime and let L/K be a Galois extension of number fields with Galois group G. Under some hypotheses, we show that Leopoldt's conjecture at p for certain proper intermediate fields of L/K implies Leopoldt's conjecture at p for L; a crucial tool will be the theory of norm relations in Q[G]. We also consider relations between the Leopoldt defects at p of intermediate extensions of L/K. Joint with Henri Johnston.

Bence Forrás
Integrality of smoothed p-adic Artin L-functions

Abstract: We consider a one-dimensional admissible p-adic Lie extension of number fields, and introduce a smoothed version of the equivariant S-truncated p-adic Artin L-function. By integrality we mean that the L-function lives inside some maximal order in the total ring of quotients of the Iwasawa algebra associated with the extension. Building on the works of Nichifor–Palvannan, Johnston–Nickel, and Lau, and assuming the Equivariant Iwasawa Main Conjecture, integrality of this L-function has been verified in general. In the special case when the extension is p-abelian, a stronger version of integrality is known unconditionally.

Stevan Gajović
Reverse-engineered Diophantine equations

Abstract: Solving some Diophantine equations can be a very difficult problem. In this talk, we will consider an opposite problem - can we construct Diophantine equations of a certain type with a prescribed set of solutions? More precisely, we consider equations of a shape $f(x) = y^n$. For a given finite set S of integral powers, we look for a polynomial f with integral coefficients such that only integral powers that appear when f is evaluated at integers are precisely those in S.

Johannes Girsch

The Doubling Method in Algebraic Families

Abstract: Local constants are an important concept in the complex representation theory of reductive p-adic groups, for example they are pivotal in the formulation of the Local Langlands correspondence. In recent years there has been progress in defining such constants for modular representations or in even more general settings. For example, Moss was able to define γ-factors for representations of $\mathrm{GL}_n(\mathbb{Q}_p)$ with coefficients in general noetherian rings and subsequently together with Helm was able to prove a converse theorem, which was crucial for the proof of the Local Langlands correspondence in families for GL_n. The aim of this talk is to show how one can extend the Doubling Method of Piateski-Shapiro and Rallis to families of representations of classical groups. In this setting we will introduce and prove a rationality result for the Doubling Zeta integrals. Subsequently we will show that these zeta integrals satisfy a functional equation from which one obtains γ-factors.

Jakob Glas

Diagonal Cubic Forms over $\mathbb{F}_q(t)$: Part II

Abstract: Understanding the set of rational points of a variety over a global field is one of the cornerstones of number theory. We report on our recent work on the distribution of rational points on diagonal cubic surfaces and fourfolds over $\mathbb{F}_q(t)$ via the circle method. Finally, we shall indicate how this leads to progress on the cubic Waring's problem over $\mathbb{F}_q(t)$.

Steven Groen

p-torsion in characteristic p of Jacobians of Artin-Schreier curves

Abstract: In characteristic 0, the geometric torsion of an Abelian varieties is well understood; there is only one possibility that occurs. However, in characteristic p, multiplication by p is inseparable, giving many possibilities for A[p]. We are particularly interested in the case when A is the Jacobian of an Artin-Schreier curve Y. Obtaining information about the p-torsion of Jac(Y) involves an analysis of the so-called Cartier operator on the space of regular differentials of Y. We survey some known results and prove that the ranks of powers of the Cartier operator lie within certain bounds, which coincide in some special cases.

Leonhard Hochfilzer

Diagonal Cubic Forms over $\mathbb{F}_q(t)$: Part I

Abstract: Understanding the set of rational points of a variety over a global field is one of the cornerstones of number theory. We report on our recent work on the distribution of rational points on diagonal cubic surfaces and fourfolds over $\mathbb{F}_q(t)$ via the circle method. Finally, we shall indicate how this leads to progress on the cubic Waring's problem over $\mathbb{F}_q(t)$.

Lukas Kofler

A plectic Langlands-Rapoport conjecture

Abstract: The Langlands-Rapoport conjecture predicts the number of points modulo p of a Shimura variety. We will look at modular curves before explaining its general formalism using motives, gerbes, and affine Deligne-Lusztig varieties. Now known in many cases due to Kisin, the conjecture is a key step in the Langlands program. The plectic conjectures of Nekovar and Scholl predict that certain Shimura varieties are equipped with additional structure of motivic origin. We will sketch how this might lead to a refinement of the Langlands-Rapoport conjecture.

Alexandros Konstantinou
A quest for deriving local formulae

Abstract: The calculation of the Mordell-Weil rank of an Abelian variety A/K remains an open problem. Unable to find a precise value for it, and in view of predictions made by the parity conjecture, one is motivated to express its parity in terms of invariants which depend on Abelian varieties defined over the various completions of K. The aim of this talk is twofold: (1) We first introduce a new method for expressing the rank parity of a certain class of abelian varieties using local data, and (2) granted the finiteness of the Tate - Shafarevich group, we show how one can obtain a local expression for the rank parity of the Jacobian variety of a curve. The content of this talk is based on joint work with V. Dokchitser, H. Green and A. Morgan.

Elvira Lupoian
tba

Abstract: tba

Lorenzo La Porta
Generalised θ operators on some unitary Shimura varieties

Abstract: The theory of the classical theta operator was instrumental in Edixhoven's proof of the weight part of Serre's modularity conjecture. Because of this, much work has been devoted to extending the construction of this operator to other Shimura varieties, with an eye towards generalisations of Serre's conjecture, or to gain insight in the Langlands programme $(\bmod\, p)$ in a broader sense. My goal is to present the construction of a new "generalised" theta operator that seems to produce exactly the weight shifts that one would expect from a representation-theoretic viewpoint and ties in neatly with the theory of generalised Hasse invariants of Boxer and Goldring-Koskivirta. I will focus on the case of Picard modular surfaces as a key example, review the construction of the "ordinary" theta operator (inspired by the work Eischen, Mantovan et al. and Goren-de Shalit) and show how one can obtain a similar differential operator on the closure of the 1-dimensional Ekedahl-Oort stratum.

Zeyu Liu
From de Rham prismatic crystals to nearly de Rham representations.

Abstract: We explain how to read off the information of a de Rham prismatic crystal over $\mathbb{O}_K$ from its associated nearly de Rham representation.

Sebastian Monnet
Parametrising number fields

Abstract: Imagine you're an undergraduate learning about fields for the first time. It might not be immediately obvious how to classify quadratic extensions of the rational numbers. An elementary argument shows that quadratic fields are in natural one-to-one correspondence with squarefree integers; we say that squarefree integers *parametrise* quadratic number fields. This parametrisation is very useful. Among other things, it lets us answer questions like "How many quadratic number fields are there with discriminant in $[-X, X]$?", for positive real numbers X. This idea has been generalised to cubic number fields by Delone-Faddeev, and to quartics and quintics by Bhargava. In this talk, I will sketch the Delone-Faddeev parametrisation of cubic number fields, as well as its application by Davenport-Heilbronn to counting cubic fields.

Ashvni Narayanan
Formalisation of p-adic L-functions in Lean

Abstract: L-functions are a well-studied part of number theory. I am working on the formalization of p-adic L-functions (attached to a Dirichlet character) in terms of a Bernoulli measure in the mathematical library of a computer language, Lean. I will also try to explain the generalization of this definition to p-adic L-functions for modular forms.

Martin Ortiz Ramirez
Prismatic F-crystals

Abstract: Prismatic F-crystals are an object in p-adic Hodge theory recently introduced by Bhatt and Scholze which nicely packages some of the previous objects in (integral) p-adic Hodge theory. I will explain what this means, making explicit the link with (ϕ, Γ)-modules.

Otto Overkamp
Jacobians of geometrically reduced curves and their Néron models

Abstract: We study the structure of Jacobians of geometrically reduced curves over arbitrary (i. e., not necessarily perfect) fields. We apply our results to prove two conjectures due to Bosch-Lütkebohmert-Raynaud about the existence of Néron models and Néron lft-models over excellent Dedekind schemes in the special case of Jacobians of geometrically reduced curves.

Jesse Pajwani
The Massey Vanishing Conjecture

Abstract: The Massey Vanishing conjecture (of Minac–Tan) is a recent (2013) conjecture concerning "Massey products" of Galois cohomology classes. The conjecture has connections to many different areas, including knot theory, the Milnor conjecture, and the inverse Galois problem. As well as this, there are many ways of approaching the problem, including changing the problem to a rational points problem for certain "splitting varieties". In this talk, I'll introduce what Massey products are and introduce the problem as stated, before highlighting its connection to other problems. I'll then end by giving a quick survey of the results in the area, ending with the recent proof of Harpaz–Wittenberg of the "weak Massey vanishing conjecture in total degree 1 for number fields".

Sunil Kumar Pasupulati
On the Existence of Euclidean ideal class in quartic, quadratic, and cubic extensions

Abstract: In 1979, Lenstra introduced the definition of the Euclidean ideal which is a generalization of Euclidean domain.

Definition. Let R be a Dedekind domain and $\mathbb{I}$ be the set of non zero integral ideals of R. If C is an ideal of R, then it is called Euclidean if there exists a function $\Psi : \mathbb{I} \to \mathbb{N}$, such that for every $I \in \mathbb{I}$ and $x \in I^{-1}C \setminus C$ there exist a $y \in C$ such that
$$\Psi\left((x - y)IC^{-1}\right) < \Psi(I).$$

Lenstra established that for a number field K with $\text{rank}(\mathcal{O}_K^\times) \geq 1$, the number ring $\mathcal{O}_K$ contains a Euclidean ideal if and only if the class group Cl_K is cyclic, provided GRH holds. Several authors worked towards removing the assumption of GRH. In this talk, I prove the existence of the Euclidean ideal class in abelian quartic fields. As a corollary, I will prove that a certain class biquadratic field with class number two has a Euclidean ideal class. I also discuss the existence of a Euclidean ideal class in certain cubic and quadratic extensions. This is joint work with Srilakshmi Krishnamoorthy.

Andrew Pearce-Crump
The Generalised Shanks' Conjecture

Abstract: In this talk we give a brief outline of the history of moments of the Riemann zeta function, $\zeta(s)$, and a related problem, known as Shanks' Conjecture. This states that $\zeta'(\rho)$ is real and positive in the mean, where the sum is over the non-trivial zeros of $\zeta(s)$. We discuss a generalisation of this result, which states that $\zeta^{(n)}(\rho)$ is real and positive/negative in the mean, depending on whether n is odd/even, and outline a proof of the result.

Josh Pimm
Shimura Correspondences and Their Generalisations

Abstract: In 1973 Shimura gave the first systematic correspondence of modular forms from half-integer weight to integer weight, a theta lift taking weight k/2 (k in 2Z+1) forms to forms of weight k-1. In 1975 Shintani established a map in the opposite direction. In this talk, I will discuss the maps of Shimura and Shintani, as well as the generalisations of Borcherds, Zagier, Li-Zemel and Duke-Jenkins. In particular, I will talk about maps between weakly holomorphic and vector-valued forms, and the appearance of the twisted trace function in fourier coefficients of lifted forms. We will also see the general compatibility with Hecke operators exhibited by these maps.

Jenny Roberts
Newform Eisenstein congruences of local origin

Abstract: The theory of Eisenstein congruences dates back to Ramanujan's surprising discovery that the Fourier coefficients of the discriminant function are congruent to the 11th power divisor sum modulo 691. This observation can be explained via the congruence of two modular forms of weight 12 and level 1; the discriminant function and the Eisenstein series, E12. We explore a generalisation of this result to newforms of weight k¿2, prime level and non-trivial character.

Katerina Santicola
Reverse Engineered Diophantine Equations over $\mathbb{Q}$

Abstract: Let $S = \{b_1, ..., b_k\} \subseteq \mathcal{P}_{\mathbb{Z}}$ be a finite set of perfect powers. Is there a polynomial $f_S \in \mathbb{Z}[x]$ such that $f_S(\mathbb{Z}) \cap \mathcal{P}_{\mathbb{Z}} = S$? This question was recently answered in the affirmative by Stevan Gajovic. We will show that the construction can be extended to $\mathbb{Q}$. Namely, we show for $S = \{b_1, ..., b_k\} \subseteq \mathcal{P}_{\mathbb{Q}}$, there exists $f_S \in \mathbb{Z}[x]$ such that $f_S(\mathbb{Q}) \cap \mathcal{P}_{\mathbb{Q}} = S$.

Sam Streeter
Semi-integral points

Abstract: In this talk we will explore two bridges from the familiar world of rational points to the mysterious realm of integral points. If the bridges are sufficiently sturdy, one might hope to wheel over rational points machinery into integral land and discover something exciting. Even if that's too much to ask, these bridges, called Campana points and Darmon points, offer us a geometric way to study solutions to equations in powerful numbers and perfect powers, the focus of major results and unsolved problems in number theory.

Jay Swar
Generalizing p-adic L-functions on moduli spaces of Galois representations

Abstract: One central highway between the theory of p-adic L-functions and Diophantine-geometric consequences is built upon their role in controlling/annihilating Selmer groups. In this talk, we'll introduce the viewpoint of p-adic L-functions in non-commutative Iwasawa theory, and see that similar phenomena exist in the theory of derived Selmer schemes.

Guillem Tarrach
S-arithmetic cohomology and p-adic automorphic forms

Abstract: In the last few decades, the theory of p-adic modular forms has seen many applications to different problems in number theory. This theory is well-understood, its central objects of study being overconvergent p-adic modular forms. However, when attempting to generalize the theory to more general reductive groups, the picture is less clear. For example, there are several different proposed definitions for spaces of p-adic automorphic forms, such as overconvergent and completed cohomology. In this talk I will introduce a different proposal, based on the study of the cohomology of p-arithmetic groups with coefficients in p-adic locally analytic representations.

Mohamed Tawfik
Brauer-Manin obstructions on Kummer surfaces of products of CM elliptic curves

Abstract: We construct a family of pairs of CM elliptic curves such that the Kummer surface of the product of each pair has non-trivial transcendental Brauer group. Then we construct the transcendental Brauer group of the Kummer surface using the work of Skorobogatov and Zarhin by finding a generator of the group. Finally, we prove the existence of a transcendental Brauer-Manin obstruction to weak approximation on the Kummer surfaces.

Justin Trias
Towards an integral theta correspondence for type II dual pairs

Abstract: The classical local theta correspondence for p-adic reductive dual pairs defines a bijection between prescribed subsets of irreducible smooth complex representations coming from two groups (H,H'), forming a dual pair in a symplectic group. Alberto Mínguez extended this result for type II dual pairs to representations with coefficients in an algebraically closed field of characteristic l as long as the characteristic l does not divide the pro-orders of H and H'. For coefficients rings like Z[1/p], we explain how to build a theory in families for type II dual pairs that is compatible with reduction to residue fields of the base coefficient ring, where central to this approach is the integral Bernstein centre. We translate some weaker properties of the classical correspondence, such as compatibility with supercuspidal support, as a morphism between the integral Bernstein centres of H and H' and interpret it for the Weil representation. In general, we only know that this morphism is finite though we may expect it to be surjective. This would result in a closed immersion between the associated affine schemes as well as a correspondence between characters of the Bernstein centre. This is current work with Gil Moss.

Harkaran Uppal
Hasse principle and cubic hypersurfaces.

Abstract: In this talk, I will introduce the Brauer-Manin obstruction. I will explain to how calculate the obstruction, to understand the failure of the Hasse principle for rational and integral points on certain cubic hypersurfaces.

Art Waeterschoot
wild models of curves via nonarchimedean geometry

Abstract: Given a smooth variety over the p-adics, one can construct a p-adic analytification as a space of geometric valuations following Berkovich, so that GAGA principles hold. The result is a nice locally compact Hausdorff topological space that is an inductive limit of certain simplicial complexes, called skeleta, that are combinatorially obtained by reductions of the variety modulo p. Given any generically étale morphism of smooth varieties over a complete discretely valued field, one can compare certain canonical skeleta in the analytifications in terms of piecewise linear functions related to logarithmic differentials. Applying this to base change morphisms of curves, one can recover results on models of curves and wild ramification.

Dmitri Whitmore

The Taylor–Wiles method for reductive groups

Abstract: The Langlands philosophy predicts a map from automorphic representations to representations of the Galois group Γ of a number field. In this talk we discuss automorphy lifting, which is a way to show a representation of Γ arises from an automorphic representation. Such a theorem is proved via the Taylor–Wiles method; we explore a generalisation allowing representations with small (residual) image. We conclude with an application to modularity of some elliptic curves, building upon the work of Boxer—Calegari–Gee–Pilloni.

Hanneke Wiersema

Modularity in the partial weight one case

Abstract: The strong form of Serre's conjecture states that a two-dimensional mod p representation of the absolute Galois group of 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.

Cameron Wilson

General Bilinear Forms over the Jacobi Symbol (and their application to rational point problems)

Abstract: tba

Siqi Yang

Computing weight one modular forms

Abstract: Weight one classical modular forms are special in the sense that they don't have a (precise) dimension formula and mod p weight one modular forms don't always lift to characteristic zero. These bring difficulties in computing the weight one modular forms, especially in characteristic p cases. This short talk will introduce the method that is given by Buzzard and further discussed by Schaeffer. We consider modular forms of higher weight to give an upper bound for the dimension of the space of weight one modular forms. Also, the associated Galois representations help us give a lower bound if we consider representations with certain properties.

Yuan Yang

Is LMFDB wrong? A small story between me and LMFDB.

Abstract: The whole story began when I was trying to find an explicit example for Gross-Zagier formula, for the modular curve $X_0(11)$ and imaginary quadratic field $\mathbb{Q}(\sqrt{-2})$. The Heegner point of discriminant -8, P, whose two j-invariants both equal 8000, which are both rational integer and this makes P a rational point on $X_0(11)$. According to LMFDB, $X_0(11)$ is an elliptic curve `11.a2` who has Mordell-Weil rank 0 and as a result P is a torsion point. But this contradicts Gross-Zagier formula, as the Gross-Zagier formula predicts P has non-zero height! Who is wrong in the whole process?

Sadiah Zahoor

Congruences related to modular forms

Abstract: The objective of this talk to introduce and prove congruences related to modular forms. Our main motivation to study such congruences is the fact that these can be used to give evidence in support of well known conjectures in Number Theory like Birch Swinnerton-Dyer conjecture and the Tamagawa conjecture of Bloch and Kato. In order to do so, we use the theory half-integer weight modular forms and the arithmetic significance of their Fourier coefficients as captured by the Waldpurger's theorem. We will show how mod p congruences between modular forms in general transcend to similar mod p congruences between half-integer weight modular forms with slightly shifted Fourier coefficients. We try to use a recipe in our proof that can be easily generalised to Hilbert modular forms over totally real quadratic fields of narrow class number 1.

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