

## List of speakers and schedule

**Denis Benois**, *Trivial zeros of  $p$ -adic  $L$ -functions*,

**Massimo Bertolini**,  *$p$ -adic Rankin  $L$ -series and syntomic regulators of Beilinson-Flach elements*,

**Thanasis Bouganis**, *Non-abelian  $p$ -adic  $L$ -functions and Eisenstein series*,

**Ellen Eischen**,  *$p$ -adic Eisenstein measures and applications*

**Takako Fukaya**, *On conjectures of Sharifi I*,

**Takashi Fukuda**, *Weber's class number one problem*,

**Ming-Lun Hsieh**, *The non-vanishing modulo  $p$  of automorphic forms*,

**Kazuya Kato**, *On conjectures of Sharifi, II*,

**Guido Kings**, *Syntomic regulators for modular forms, Panchishkin's measure and applications*,

**Shinichi Kobayashi**, *The  $p$ -adic Gross-Zagier formula at supersingular primes*,

**Jan Kohlhaase**, *Iwasawa modules arising from deformation spaces of  $p$ -divisible formal group laws*,

**Keiichi Komatsu**, *Weber's class number one problem*,

**David Loeffler**, *Two-variable Iwasawa theory for modular forms*,

**Takayuki Morisawa**, *Weber's class number one problem*,

**Karl Rubin**, *Higher rank Kolyvagin systems*,

**Romyar Sharifi**, *A conjecture of Khare and Wintenberger*,

**Michael Spiess**, *Shintani Cocycles and  $p$ -adic  $L$ -series of totally real fields*,

**Ramdorai Sujatha**, *Noncommutative Iwasawa theory for modular forms*,

**Eric Urban**, *Vanishing of  $L$ -functions and Selmer groups for elliptic curves*,

**David Vauclair**, *The main conjecture for abelian varieties over function fields*,

**Malte Witte**, *On a non-commutative main conjecture for abelian varieties over function fields*.

## Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 am	Registration & Coffee 8:00-9:20				
8:30 am					
9:00 am	Welcome: 9:20-9:30				
9:30 am					
10:00 am	E. Urban	M. Bertolini	K. Rubin	T. Fukaya	D. Benois
10:30 am	Coffee break 10:30-11:00	Coffee break 10:30-11:00	Coffee break 10:30-11:00	Coffee break	Coffee break 10:30-11:00
11:00 am	S. Kobayashi	G. Kings	M. Spiess	K. Kato	D. Loeffler
11:30 am				Coffee break	
12:00 am	Lunch 12:00-14:00	Lunch 12:00-14:00	Lunch 12:00-14:00	R. Sharifi	Lunch 12:00-14:00
12:30 am					
1:00 pm			Neckar River Cruise / Walk	Lunch 13:00-14:00	
1:30 pm					
2:00 pm	M.-L. Hsieh	D. Vaclair		R. Sujatha	Th. Bouganis
2:30 pm					
3:00 pm	Coffee break 15:00-15:30	Coffee break 15:00-15:30		Coffee break 15:00-15:30	Coffee break 15:00-15:30
3:30 pm	E. Eischen	M. Witte		J. Kohlhaase	T. Fukuda, K. Ko- matsu, T. Morisawa
4:00 pm					
4:30 pm				Poster Session	
5:00 pm					
5:30 pm					
6:00 pm					
6:30 pm					
7:00 pm		Conference Dinner 19:00			
7:30 pm					
8:00 pm					

## Abstracts

### **E. Urban (*CNRS Jussieu*) - Vanishing of $L$ -functions and Selmer groups for elliptic curves**

I will sketch the proof that the corank of the  $p$ -Selmer group of a rational semi-stable elliptic curve  $E$  is positive whenever  $L(E, 1) = 0$  and  $p$  is a prime of good reduction for  $E$ . This is a joint work in progress with C. Skinner.

### **S. Kobayashi (*Tohoku University*) - The $p$ -adic Gross-Zagier formula at supersingular primes**

We explain the  $p$ -adic Gross-Zagier formula for elliptic curves at supersingular primes and its proof.

### **M.-L. Hsieh (*National Taiwan University*) - The non-vanishing modulo $p$ of automorphic forms**

We will talk about the non-vanishing modulo  $p$  of certain  $p$ -ordinary Eisenstein series on the quasi-split unitary group of degree three and the application to the Iwasawa main conjecture for CM fields. The non-vanishing of Kudla lifts and its connection with certain anticyclotomic main conjecture for modular forms will be also discussed.

### **E. Eischen (*Northwestern University*) - $p$ -adic Eisenstein measures and applications**

One approach to constructing certain  $p$ -adic  $L$ -functions relies on the construction of a  $p$ -adic Eisenstein measure. We will discuss how to construct  $p$ -adic Eisenstein measures for certain unitary groups. As part of the construction, we will  $p$ -adically interpolate special values of both holomorphic and non-holomorphic Eisenstein series. We will also discuss applications.

### **M. Bertolini (*Università di Milano*) - $p$ -adic Rankin $L$ -series and syntomic regulators of Beilinson-Flach elements**

This talk reports on joint work with Henri Darmon and Victor Rotger on a Beilinson formula for the  $p$ -adic  $L$ -series associated to the Rankin convolution of two Hida families of cusp forms. It describes the near-central value of this  $L$ -series in terms of the syntomic regulator of Beilinson-Flach elements in the first  $K$ -group of a product of modular curves.

### **G. Kings (*Universität Regensburg*) - Syntomic regulators for modular forms, Panchishkin's measure and applications**

(joint with Niklas Bannai) In this lecture we compute the syntomic regulator of the  $K$ -theory elements for modular forms introduced by Beilinson and Scholl in terms of Panchishkin's convolution measure. As a consequence the different regulators can be  $p$ -adically interpolated. We also discuss applications to Perrin-Riou's conjecture about special values of  $p$ -adic  $L$ -functions.

**D. Vauclair (*Université de Caen*) - The main conjecture for abelian varieties over function fields**

Consider an abelian variety over a function field  $F$  of characteristic  $p$  and  $G = \text{Gal}(F_\infty/F)$  a  $p$ -adic Lie group with associated Iwasawa algebra  $\Lambda = \mathbb{Z}_p[[G]]$ . Under several restrictive assumptions, we prove that a suitable version of the Selmer complex gives rise to a class in  $K_0(\Lambda, \Lambda_{S^*})$  and that the crystalline interpretation of this Selmer complex yields a canonical element  $\mathcal{L} \in \mathcal{K}_\infty(*_{S^*})$  which lifts the class of the Selmer complex and encodes the value at  $s = 1$  of the Hasse-Weil L-function twisted by any Artin character of  $G$ . This is a joint work with Fabien Trihan.

**M. Witte (*Universität Heidelberg*) - On a non-commutative main conjecture for abelian varieties over function fields.**

We shall formulate and prove a non-commutative Iwasawa main conjecture for the  $\ell$ -Selmer group of an abelian variety over a function field of characteristic  $p$  with  $\ell \neq p$ .

**K. Rubin (*University of California Irvine*) - Higher rank Kolyvagin systems**

Both a rank-one Euler system and a rank-one Kolyvagin system consist of families of cohomology classes with appropriate properties and interrelationships. Given such an Euler system, Kolyvagin's derivative construction produces a rank-one Kolyvagin system, and a rank-one Kolyvagin system gives a bound on the size of a Selmer group. Ideas and conjectures of Perrin-Riou show that in some situations (for example, starting with an abelian variety of dimension  $r$ , or the global units in a totally real field of degree  $r$ ) an Euler system is more naturally a collection of elements in the  $r$ -th exterior powers of cohomology groups. In this situation, Barry Mazur and I define a Kolyvagin system of rank  $r$  also to be a suitable collection of elements in  $r$ -th exterior powers, and we show how a Kolyvagin system of rank  $r$  bounds the size of the corresponding Selmer group.

**M. Spiess (*Universität Bielefeld*) - Shintani Cocycles and  $p$ -adic  $L$ -series of totally real fields**

**T. Fukaya (*University of Chicago*) - On conjectures of Sharifi I**

R. Sharifi has formulated mysterious conjectures on the relation between the arithmetic of cyclotomic fields and modular curves. The purpose of the talk is to give partial results on his conjectures. This is joint work with Kazuya Kato.

**K. Kato (*University of Chicago*) - On conjectures of Sharifi, II**

This will be a continuation of the talk of Takako Fukaya. I explain our method to attack the conjectures of Sharifi. If time permits, I will describe the attempts with T. Fukaya and R. Sharifi to generalize conjectures of Sharifi to more general Galois representations.

**R. Sharifi (*University of Arizona*) - A conjecture of Khare and Wintenberger**

I will discuss the “reciprocity conjecture“ of Khare and Wintenberger and a proof of a refinement of it. The conjecture asserts the equality of two subgroups of an Iwasawa module over the cyclotomic  $\mathbb{Z}_p$ -extension of a totally real field. The two subgroups are associated to two primes of the totally real field, one being an extension class defined by a ray class group of conductor the product of the two primes, the other being in a sense generated by the two Frobenius elements attached to the primes.

**R. Sujatha (*University of British Columbia*) - Noncommutative Iwasawa theory for modular forms**

**J. Kohlhaase (*Universität Münster*) - Iwasawa modules arising from deformation spaces of  $p$ -divisible formal group laws**

Let  $G$  be a  $p$ -divisible formal group law over an algebraically closed field of characteristic  $p$ . We show that the universal deformation ring of  $G$  naturally is a pseudocompact module over the Iwasawa algebra of the automorphism group of  $G$ . Further, the ring of global rigid analytic functions on the universal deformation space is dual to a locally analytic representation of  $\text{Aut}(G)$ . If the dimension of  $G$  is one, we present first results on the structure of these objects.

**D. Benois (*Université Bordeaux*) - Trivial zeros of  $p$ -adic  $L$ -functions**

Using the theory of  $(\varphi, \Gamma)$ -modules we prove a Mazur-Tate-Teitelbaum style formula for  $p$ -adic  $L$ -functions of modular forms at near central points.

**D. Loeffler (*University of Warwick*) - Two-variable Iwasawa theory for modular forms**

In Perrin-Riou’s conjectural picture of Iwasawa theory for motives over the cyclotomic tower, a key role is played by her ”exponential” and ”logarithm” maps, which link local Iwasawa cohomology groups with  $p$ -adic  $L$ -functions. I’ll discuss a generalization of these maps where the cyclotomic tower is replaced by the  $\mathbb{Z}_p^2$ -extension of  $\mathbb{Q}_p$ , which extends earlier work of Yager and of Ochiai. This is joint work with Sarah Zerbes. This construction leads to a natural conjectural picture of global Iwasawa theory for modular forms over the  $\mathbb{Z}_p^2$ -extension of an imaginary quadratic field, and I will conclude with some recent results together with Zerbes and Antonio Lei concerning the construction of an analogue of Kato’s Euler system in this context.

**Th. Bouganis (*Universität Heidelberg*) - Non-abelian  $p$ -adic  $L$ -functions and Eisenstein series**

In this lecture we will discuss an approach to tackling some non-abelian congruences between  $L$ -values (of various motives), which have their origin in non-commutative Iwasawa theory. Our approach relies on the theory of Eisenstein series and the so-called doubling method.

**T. Fukuda (*Nihon University*), K. Komatsu (*Waseda University*), T. Morisawa (*Waseda University*) - Weber's class number one problem**

We talk about the following problem: Are the class numbers of the  $n$ -th layers of the  $\mathbb{Z}_p$ -extensions of  $\mathbb{Q}$  one for any positive integers  $n$  and prime numbers  $p$ ? Moreover, we discuss Coates' conjecture.