

Universität Bielefeld



p – adic Hodge theory and Iwasawa theory

14–18 September 2015

Faculty of Mathematics
Bielefeld University
Lecture Room: H6

This workshop is part of the DFG-funded CRC 701
Spectral Structures and Topological Methods in Mathematics
at Bielefeld University

This workshop is supported by Paderborn University

Organisers: Eike Lau, Andreas Nickel, Thomas Zink

www.math.uni-bielefeld.de/sfb701/2015_padicHodgeIwasawa/

Schedule: Monday September 14th

Lecture Room: **H6**

09:00 – 09:30 **Registration** (Room V3-201)

09:30 – 10:30 **Benjamin Schraen** (CNRS)
Infinitesimal character and p -adic Banach representations

10:30 – 11:00 **Coffee Break and Registration** (Room V3-201)

11:00 – 12:00 **Fabian Januszewski** (Karlsruhe)
On rational structures on automorphic representations and applications
to special values of L -functions

12:00 – 14:00 **Lunch Break**

14:00 – 15:00 **Eugen Hellmann** (Bonn)
Classicality and degenerations of trianguline representations

15:00 – 15:30 **Coffee Break** (Room V3-201)

15:30 – 16:30 **Denis Benois** (Bordeaux)
On p -adic height pairings

Schedule: Tuesday September 15th

Lecture Room: **H6**

09:30 – 10:30 **Jean-Pierre Wintenberger** (Strasbourg)
Ramification and Iwasawa modules

10:30 – 11:00 **Coffee Break** (Room V3-201)

11:00 – 12:00 **Henri Johnston** (Exeter)
The p -adic Stark conjecture at $s = 1$ and the equivariant Tamagawa number conjecture

12:00 – 14:00 **Lunch Break**

14:00 – 15:00 **Gergely Zábrádi** (Budapest)
Links between generalized Montréal functors

15:00 – 15:30 **Coffee Break** (Room V3-201)

15:30 – 16:30 **Laurent Fargues** (Jussieu)
From local class field theory to the curve and vice versa

Schedule: Wednesday September 16th

Lecture Room: **H6**

09:30 – 10:30 **Farid Mokrane** (Paris)
Overconvergent Hodge-Tate-Igusa map and p -adic families of modular forms

10:30 – 11:00 **Coffee Break** (Room V3-201)

11:00 – 12:00 **Lennart Gehrmann** (Duisburg-Essen)
Shalika models and p -adic L -functions

12:15 – 13:15 **Laurent Berger** (Lyon)
Iwasawa theory of F -analytic representations

Free afternoon

19:00 **Conference dinner** (restaurant 'Numa', Obernstraße 26)

Schedule: Thursday September 17th

Lecture Room: **H6**

09:30 – 10:30 **Guido Kings** (Regensburg)
Explicit reciprocity laws via the Eisenstein-Iwasawa class

10:30 – 11:00 **Coffee Break** (Room V3-201)

11:00 – 12:00 **Otmar Venjakob** (Heidelberg)
Iwasawa cohomology and (ϕ, Γ) -modules over Lubin Tate extensions

12:00 – 14:00 **Lunch Break**

14:00 – 15:00 **Veronika Ertl** (Regensburg)
Arithmetic and rigid syntomic cohomology

15:00 – 15:30 **Coffee Break** (Room V3-201)

15:30 – 16:30 **Matteo Longo** (Padova)
Variation of anticyclotomic Iwasawa invariants in Hida families

Schedule: Friday September 18th

Lecture Room: **H6**

09:30 – 10:30 **Robert Pollack** (Boston)
Slopes of modular forms and the ghost conjecture

10:30 – 11:00 **Coffee Break** (Room V3-201)

11:00 – 12:00 **Matthew Morrow** (Bonn)
Integral p -adic Hodge theory and de Rham–Witt complexes

12:15 – 13:15 **Kiran Kedlaya** (San Diego)
Imperfect vs. perfect (ϕ, Γ) -modules

Abstracts

Denis Benois (Bordeaux)

On p -adic height pairings

In the first part of this talk we generalize Nekovář's construction of p -adic heights for Selmer complexes to the non-ordinary case. In the second part, we discuss some applications of this construction to the Iwasawa theory of modular forms (joint work in progress with Kazim Büyükboduk).

Laurent Berger (Lyon)

Iwasawa theory of F -analytic representations

The goal of this talk is to explain some recent results concerning 'Lubin-Tate (ϕ, Γ) -modules'. As in the classical cyclotomic case, one can use them to construct cohomology classes, and then elements of the Iwasawa cohomology groups. I will review the relevant objects, the construction of cohomology classes, and give explicit formulas relating Bloch-Kato's exponential map and these classes. Joint work with L. Fourquaux.

Veronika Ertl (Regensburg)

Arithmetic and rigid syntomic cohomology

I will discuss properties of the recently developed arithmetic syntomic cohomology due to Nekovář-Nizioł that generalises log-syntomic cohomology, and Besser's rigid syntomic cohomology, and lie out a comparison, using methods developed by Kurihara, with the goal of extending this comparison to more general cases. Part of what I will discuss is work in progress.

Laurent Fargues (Jussieu)

From local class field theory to the curve and vice versa

I will speak about results contained in my article " G -torseurs en théorie de Hodge p -adique" linked to local class field theory. I will in particular explain the computation of the Brauer group of the curve and why its fundamental class is the one from local class field theory.

Lennart Gehrmann (Duisburg-Essen)

Shalika models and p -adic L -functions

p -adic L -functions for cohomological cuspidal automorphic representations of $GL(2n)$, which have a Shalika model, were first constructed by Ash and Ginzburg in the case of trivial coefficients. We will discuss a new, more conceptual construction, which works for arbitrary coefficients.

Eugen Hellmann (Bonn)

Classicality and degenerations of trianguline representations

We prove new classicality criteria for overconvergent p -adic automorphic forms of finite slope on definite unitary groups. These criteria are formulated in terms of the local geometry of a space parametrizing trianguline representations. Trianguline representations are a class of representations of the Galois group of a local p -adic field. By definition the (ϕ, Γ) -module over the Robba ring associated to a trianguline representation admits a complete flag stable under ϕ and Γ . These representations naturally vary in rigid analytic families and may be seen as a counterpart of eigenvarieties. This is joint work with C. Breuil and B. Schraen.

Fabian Januszewski (Karlsruhe)

On rational structures on automorphic representations and applications to special values of L -functions

In the 90ies Clozel identified an important class of automorphic representations of $GL(n)$, which conjecturally correspond to motives. This raises the question how rationality properties of motives are reflected on the automorphic side. In this talk I will discuss the existence of global rational structures on automorphic representations and present applications to special values of L -functions.

Henri Johnston (Exeter)

The p -adic Stark conjecture at $s=1$ and the equivariant Tamagawa number conjecture

The ‘ p -adic Stark conjecture at $s=1$ ’ is formulated for a finite Galois extension of totally real number fields L/K and a prime p . It relates the leading terms at $s=1$ of p -adic Artin L -functions to those of the complex Artin L -functions attached to L/K . When $L=K$ this is equivalent to Leopoldt’s conjecture for L at p and the ‘ p -adic class number formula at $s=1$ ’ of Colmez. An important motivation for studying the p -adic Stark conjecture at $s=1$ is that Burns and Venjakob have shown that it allows one to ‘descend’ from the equivariant Iwasawa main conjecture to deduce the relevant special case of the equivariant Tamagawa number conjecture (ETNC). We prove the p -adic Stark conjecture at $s=1$ for absolutely abelian extensions and use the representation theory of finite groups to reduce it to Leopoldt’s conjecture for many non-abelian extensions. As a consequence, we obtain strong new evidence for certain cases of the ETNC. This is work in progress joint with Andreas Nickel.

Kiran Kedlaya (San Diego)

Imperfect vs. perfect (ϕ, Γ) -modules

In the original evolution of the theory of (ϕ, Γ) -modules out of the work of Fontaine, Colmez, Berger, et al., the base rings were certain rings of power series with p -adic coefficients. These rings carry certain Frobenius lifts which are injective but not surjective. By contrast, if one revisits this theory within the framework of perfectoid algebras, one gets a parallel theory in which the base rings have bijective Frobenius actions, and the role of the cyclotomic tower can be played by an arbitrary strictly APF extension. It is thus reasonable to ask to what extent constructions from the original theory can or cannot be replicated in the perfectoid setting; we will discuss some positive and negative answers to this question.

Guido Kings (Regensburg)

Explicit reciprocity laws via the Eisenstein-Iwasawa class

In our joint work with Loeffler and Zerbes an explicit reciprocity law for Rankin-convolutions of modular forms was proved, which leads to new finiteness results on the Tate-Shafarevich group for elliptic curves. The strategy of the proof relies on using non-critical points of the p -adic L -function and a theory of p -adic interpolation of the étale realization of motivic Eisenstein classes via the so called Eisenstein-Iwasawa class. In this talk we explain our approach, discuss other cases where this strategy works and describe a new result, which generalizes the Eisenstein-Iwasawa classes.

Matteo Longo (Padova)

Variation of anticyclotomic Iwasawa invariants in Hida families

Given a modular form f and a quadratic imaginary field K , one can form a p -adic L -function interpolating central critical values of the complex L -function of f twisted by characters of the anticyclotomic \mathbb{Z}_p -extension of K . Under suitable parity conditions, one shows that this p -adic L -function is non-zero, and we can consider its μ and λ Iwasawa invariants. When f lives in a Hida family, we show that these invariants are constants on branches, obtaining an anticyclotomic analogue of a similar result by Emerton-Pollack-Weston in the cyclotomic setting. This result allows us to spread results on the main conjecture from one form to all other forms in the family, obtaining new cases of the anticyclotomic main conjecture. This is a joint work with F. Castella and C.-H. Kim.

Farid Mokrane (Paris)

Overconvergent Hodge-Tate-Igusa map and p -adic families of modular forms

The classical Hodge-Tate map of the connected p -divisible group of the universal ordinary abelian variety extends to a strict neighborhood of the ordinary locus and allows us to interpolate Siegel modular forms when the weight varies. I will give some elements of the proof of these facts, these will be related to toroidal compactifications and Mumford quotients. This is joint work with Olivier Brinon and Jacques Tilouine.

Matthew Morrow (Bonn)

Integral p -adic Hodge theory and de Rham–Witt complexes

I will speak about the construction of a new integral p -adic cohomology theory interpolating crystalline and étale, obtained by glueing de Rham–Witt complexes and the pro-étale cohomology of period sheaves. This is joint work with B. Bhatt and P. Scholze.

Robert Pollack (Boston)

Slopes of modular forms and the ghost conjecture

In this talk, we present a new conjecture on slopes of p -adic modular forms. We write down a relatively simple and explicit power series over weight space and conjecture, in the $\Gamma_0(N)$ -regular case, that this power series knows the slopes of the U_p operator acting on all spaces of overconvergent modular forms. Precisely, we conjecture that the Newton polygon of our series evaluated at a weight k (classical or not) matches the Newton polygon of the characteristic power series of U_p acting on weight k overconvergent modular forms. We call this power series the “ghost series” as its spectral curve hovers around the true spectral curve.

In this talk, we will explain this ghost conjecture and its connections to other conjectures on slopes (e.g. Buzzard’s conjecture, the Gouvea-Mazur conjecture, Coleman’s spectral halo) and discuss implications for the shape and structure of the eigencurve.

This is a joint project with John Bergdall.

Benjamin Schraen (CNRS)

Infinitesimal character and p -adic Banach representations

I’ll explain how to prove the existence of an infinitesimal character on the locally analytic vectors of certain p -adic Banach representations appearing as Hecke eigenspaces in some completed cohomology spaces. I’ll draw some consequences concerning the canonical dimension of these p -adic Banach representations.

Otmar Venjakob (Heidelberg)

Iwasawa cohomology and (ϕ, Γ) -modules over Lubin Tate extensions

We generalize work of Fontaine and Herr about expressing local Galois cohomology and Iwasawa cohomology in terms of (ϕ, Γ) -modules from the cyclotomic case to the case of Lubin-Tate extensions. In particular we show a kind of reciprocity law which admits to calculate the image of an adequate Kummer map in the first Iwasawa cohomology group. This is joint work with Peter Schneider (Münster).

Jean-Pierre Wintenberger (Strasbourg)

Ramification and Iwasawa modules

We give criteria for Leopoldt’s conjecture and we construct by modular means a Galois representation whose ramification satisfies most of the properties of the criteria. (jw C. Khare)

Gergely Zábrádi (Budapest)

Links between generalized Montréal functors

Let G be the group of \mathbb{Q}_p -points on a \mathbb{Q}_p -split connected reductive group with connected centre. There are (at least) two candidates (one by Breuil and the other by Schneider and Vignéras) for the generalization of Colmez’s “Montréal functor” (from the case $G = \mathrm{GL}_2(\mathbb{Q}_p)$ to this generality) adjoining a (generalized) étale (ϕ, Γ) -module to a smooth mod p^n representation π of G . In the talk I will show how to obtain Breuil’s (ϕ, Γ) -module by a series of taking étale hull, localisation, and pseudocompact completion of the Schneider-Vignéras functor. Moreover, assuming certain nonvanishing of a variant of Breuil’s functor we show how to realize the Pontryagin dual of π as a G -invariant subspace in the global sections of a G -equivariant sheaf on the flag variety G/B where B is a Borel subgroup. This is joint work with M. Erdélyi.

Participant List

Kiran Adhikari	(Tribhuvan University)
Anwar Alameddin	(University of Liverpool)
Johannes Anschütz	(Universität Heidelberg)
Grzegorz Banaszak	(Adam Mickiewicz University, Poznań, Poland)
Debargha Banerjee	(IISER, Pune)
Sebastian Bartling	(Bielefeld University)
Denis Benois	(Université de Bordeaux)
Laurent Berger	(ENS de Lyon)
Felix Bergunde	(Bielefeld University)
Dorota Blinkiewicz	(Adam Mickiewicz University, Poznań, Poland)
Francesc Castella	(UCLA)
Andre Chatzistamatiou	(MPI Bonn)
Wei Chen	(Universität Duisburg-Essen)
Alessandro Cobbe	(Universität der Bundeswehr München)
Lassina Dembele	(Warwick University)
Yara Elias	(Max Planck Institute)
Veronika Ertl	(Universität Regensburg)
Laurent Fargues	(CNRS - Institut de Mathématiques de Jussieu)
Francesc Fité	(Universität Duisburg Essen)
Michael Fütterer	(Universität Heidelberg)
Lennart Gehrmann	(Universität Duisburg-Essen)
Oli Gregory	(University of Exeter)
Guhanvenkat Harikumar	(Universite de Bordeaux)
Shin Hattori	(Kyushu University)
Eugen Hellmann	(University of Bonn)
Martin Hofer	(LMU München)
Muhammad Imran	(National University of Sciences & Technology, Islamabad, Pakistan)
Fabian Januszewski	(Karlsruher Institut für Technologie)
Henri Johnston	(University of Exeter)
Kiran Kedlaya S.	(University of California, San Diego)
Guido Kings	(Universität Regensburg)
Piotr Krason	(Szczecin University)
Andreas Langer	(University of Exeter)
Eike Lau	(Universität Paderborn)
Matteo Longo	(University of Padova)
Kakde Mahesh	(King's College London)
Abdallah Mokrane Farid	(Paris 8 University)
Stefano Morra	(Université de Montpellier)
Jonas Morrissey	(University of Bonn)
Matthew Morrow	(University of Bonn)
Andreas Nickel	(Bielefeld University)
Aprameyo Pal	(Universität Duisburg-Essen)
Aftab Pande	(UFRJ and UPMC)
Thomas Poguntke	(HCM Bonn)
Robert Pollack	(Boston University)
Jyoti Saha Prakash	(Max Planck Institute for Mathematics)
Alexandre Pyvovarov	(Universität Duisburg-Essen)

Andreas Riedel	(Universität Heidelberg)
Nils Romaker	(Bielefeld University)
Benjamin Schraen	(CNRS)
Michael Spieß	(Bielefeld University)
Kwok Wing Tsoi	(University College London)
Shen-Ning Tung	(Universität Duisburg-Essen)
Otmar Venjakob	(Universität Heidelberg)
Carlos de Vera Piquero	(Universität Duisburg-Essen)
David Watson	(Exeter University)
Jean-Pierre Winterberger	(Université de Strasbourg)
Peng Xu	(University of Warwick)
Gergely Zábrádi	(Eötvös University, Budapest)
Yasin Zaehring	(King's College London)
Thomas Zink	(Bielefeld University)

General Information

Seminar Room

The Seminar Room V3-204 will be available for participants of the workshop.

WiFi

You can use your eduroam account.

In case you don't have an eduroam account, you may use the personalised WiFi account which you find in your conference folder and

- connect to “guest” network
- open a Browser
- enter your login-information on the startup page

If you are having trouble, you may ask the SFBWeb - Team (office: V3-208) for assistance.

Mensa / Cafeteria

There are several possibilities to have lunch around the campus. All of them allow for cash payment. See the map for locations.

- Mensa offers menus and a buffet
(look out for “Barzahlung” checkout)
open from 11:30 to 14:30 (“Building X”)
- Cafeteria offers snacks (warm and cold) and beverages
open from 08:00 to 18:00 (next to the Mensa, “Building X”)
- Westend offers snacks (warm and cold) and beverages
open from 08:00 to 20:00 (“Main Building”)
- Univarza Restaurant
open from 08:00 to 21:00 (“Main Building”)
- Eddy Grocery Store (“Main Building”)
Mon – Thu 07:00 to 19:00
Fri 07:00 to 18:30

Cash Machines

You find cash machines in the hall of the “Main Building” (Sparkasse) and in the lobby of “Building X” (Sparkasse and Volksbank).

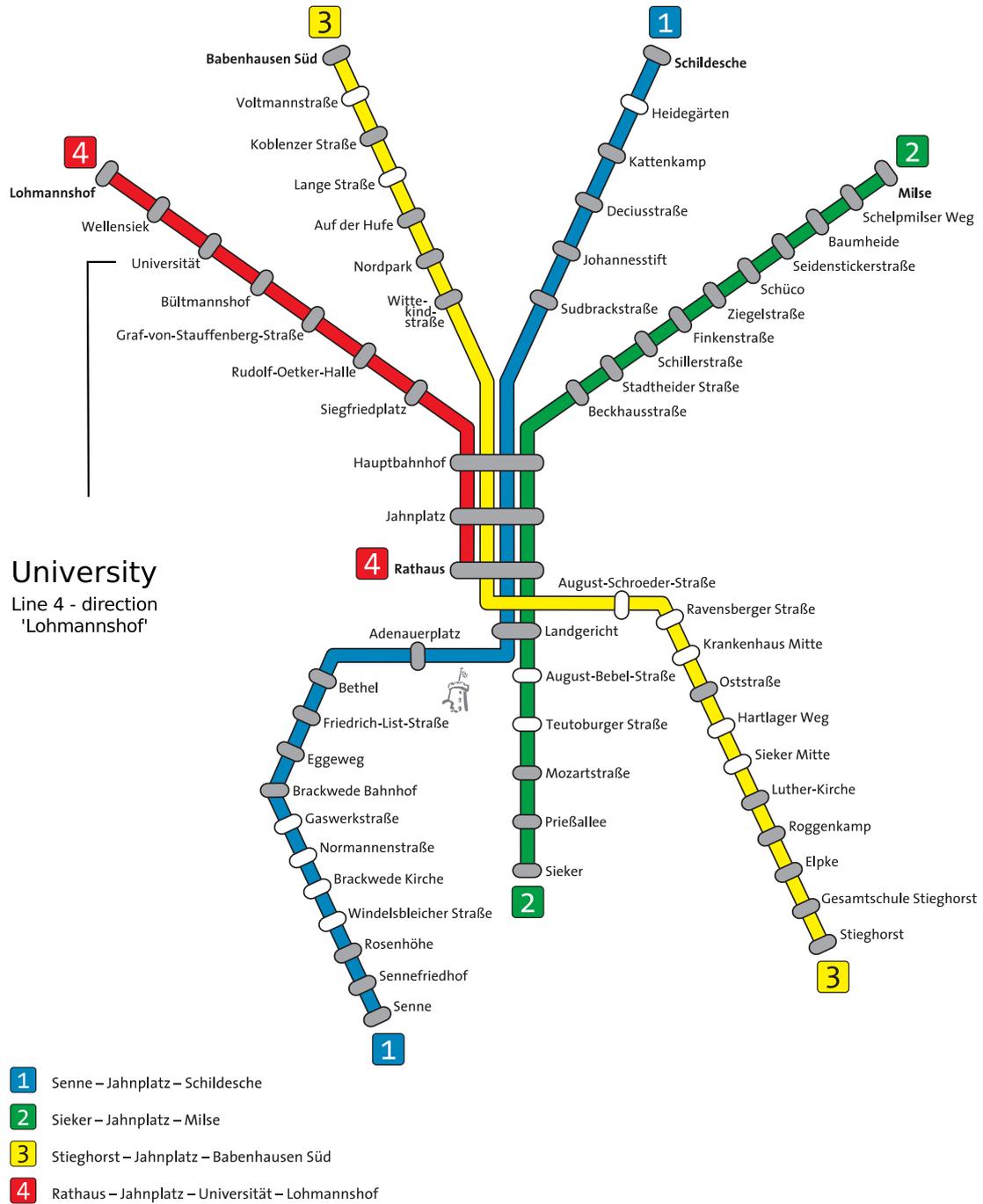
Public Transport

Take the tram line 4 (red line) for rides between the University and the city centre. For an individual ticket choose the options "Einzelticket, Preisstufe 1 Bielefeld" at EURO 2,40. If you are already aware of the fact that you will use public transport more often, it's worth buying a so-called "4er-Ticket" for four trips at the prize of EURO 8,20 (on each trip you validate the ticket in the orange machines inside the tram).

Library

The library is located on the first floor of the "Main Building". The math section can be entered between building parts U and V. Bags can be stored in the lockers in front of the entrance.

Tram map



Campus map

