SFB/TR 45
Periods, Moduli Spaces,
and Arithmetic of Algebraic Varieties

universitätbonn

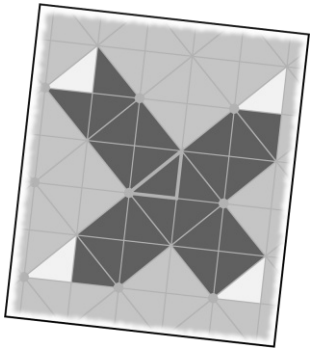
hausdorff center for mathematics

Conference on

Arithmetic Algebraic Geometry

on the occasion of Michael Rapoport's 60th birthday

Bonn • Oct. 6 - Oct. 10, 2008



Mathematisches Institut
der Universität Bonn
Wegelerstr. 10
53115 Bonn

Organizing committee

Ulrich Görtz

Sascha Orlik

Torsten Wedhorn

Stefan Müller-Stach

http://aag-bonn08.sfb45.de/

Talks

Monday, Oct 6

9:00 Pierre Colmez

On the p-adic local Langlands correspondence for GL2(Qp)

10:30 Jean-Loup Waldspurger

An integral formula related to the local Gross-Prasad conjecture

11:45 Urs Hartl

The Newton stratification on deformations of local G-shtuka

15:30 Jochen Heinloth

On moduli spaces of G-bundles and their cohomology

16:45 Thomas Zink

A de Rham-Witt complex for rigid cohomology

Tuesday, Oct 7

9:00 Eva Viehmann

Generalized affine Springer fibres associated to non-equivalued root valuation strata

10:30 Guy Henniart

Clifford Theory for reductive p-adic groups

11:45 George Pappas

Phi-modules and coefficient spaces for Galois representations

15:30 Alain Genestier

16:45 Michael Harris

Functoriality and construction of automorphic Galois representations

Wednesday, Oct 8

9:00 Bao Châu Ngô

The support of simple perverse sheaves in the decomposition theorem

10:30 Markus Reineke

Moduli spaces of representations of quivers

11:45 Stephen Kudla

Arithmetic cycles for unitary groups

Thursday, Oct 9

9:00 Jean-François Dat

Looking for a geometric interpretation of the (mod l) local Langlands correspondence

10:30 Laurent Lafforgue

Trying to build a kernel for functoriality: the case of unramified automorphic induction from GL(1) to GL(2)

11:45 Thomas Haines

Shimura varieties with Gamma_1(p)-level structure and Hecke algebra isomorphisms

15:30 Teruyoshi Yoshida

Remarks on Lubin-Tate theory

16:45 Mark Kisin

Shimura varieties mod p

Friday, Oct 10

9:00 Robert Kottwitz

Dimensions and non-emptiness of affine Deligne-Lusztig varieties

10:30 Laurent Fargues

The p-adic geometry of moduli spaces of abelian varieties and p-divisible groups

11:45 Gerd Faltings

The isomorphism between Drinfeld's and Lubin-Tate's tower

14:00 Gérard Laumon

The weighted fundamental lemma

Abstracts

Jean-François Dat

Looking for a geometric interpretation of the (mod ℓ) local Langlands correspondence

The ℓ-adic or complex local Langlands correspondence is characterized by matching of L-functions and epsilon factors. Vigneras has established a Langlands-type correspondence for mod ℓ representations. Although L-functions and epsilon factors have been defined for such representations, they are too coarse invariants for the purpose of characterizing such a correspondence. In this talk we will prospect a geometric-cohomological interpretation of (some special cases) of the correspondence, using Drinfeld's spaces and their similarities with Deligne-Lusztig varieties.

Gerd Faltings

The isomorphism between Drinfeld's and Lubin-Tate's tower

The isomorphism between the two towers extends to other coverings of period domains. We explain the construction of such an isomorphism.

Laurent Fargues

The p-adic geometry of moduli spaces of abelian varieties and p-divisible groups

We first define and study an Hecke equivariant cellular parametrization by Bruhat-Tits buildings of the p-adic Berkovich spaces associated to the Lubin-Tate tower. We extend this to a parametrization by compactifications of those buildings of the whole unitary type with signature $(1, n-1)$ Shimura varieties. We will then present a Harder-Narasimhan type theory that allows us to give such parametrizations for all Shimura varieties and moduli spaces of p-divisible groups.

Thomas Haines

Shimura varieties with $\Gamma_1(p)$-level structure and Hecke algebra isomorphisms

This talk will discuss a program to study the reduction modulo p of Shimura varieties with $\Gamma_1(p)$-level structure by relating them to Shimura varieties with Iwahori level structure. One ingredient is a base change fundamental lemma for central elements in the Hecke algebra associated to a type of the form (I, χ) (here χ is a character on an Iwahori subgroup I which is trivial on the pro-unipotent radical of I). This is joint work in progress with Michael Rapoport.

Urs Hartl

The Newton stratification on deformations of local G-shtuka

(joint work with Eva Viehmann) Bounded local G-shtuka are function field analogs for p-divisible groups with extra structure. We describe their deformations and moduli spaces. The latter are analogous to Rapoport-Zink spaces for p-divisible groups. The underlying schemes of these moduli spaces are affine Deligne-Lusztig varieties. For basic Newton polygons the closed Newton stratum in the universal deformation of a local G-shtuka is isomorphic to the completion at the corresponding point of the affine Deligne-Lusztig variety. This yields bounds on the dimension and proves equidimensionality of the basic affine Deligne-Lusztig varieties.

Jochen Heinloth

On moduli spaces of G-bundles and their cohomology

This is a report on work on the geometry of moduli spaces of torsors under non-constant group schemes on curves. The basic geometric invariants of these spaces have been conjectured by Pappas and Rapoport. I'd like to explain how the more general setup helps to shorten the computation of these invariants and indicate that these results also suggest what the structure of the cohomology of these spaces should be.

Guy Henniart

Clifford Theory for reductive p-adic groups

(Joint work in progress with C. J. Bushnell) Let F be a p-adic field. The absolute Galois group G_F of F has a distinguished pro-p subgroup, the wild ramification subgroup P_F. Clifford Theory relates the irreducible representations of G_F to those of P_F. Via the Langlands correspondence, this can be conjecturally transferred, for a reductive group H over F, to a relation between irreducible smooth representations of G, and simple characters in the sense of Bushnell-Kutzko. We shall state results for $H = GL(N, F)$, and speculations for classical groups over F.

Mark Kisin

Shimura varieties mod p

I will report on some recent progress on a conjecture of Langlands-Rapoport, describing the mod p points of a Shimura variety.

Robert Kottwitz

Dimensions and non-emptiness of affine Deligne-Lusztig varieties

The talk will report on joint work of Goertz-Haines-Kottwitz-Reuman on dimensions and non-emptiness of affine Deligne-Lusztig varieties in the affine flag manifold and will also review some of the other facts known about affine Deligne-Lusztig varieties.

Stephen Kudla

Arithmetic cycles for unitary groups

In this talk I will discuss recent joint work with Rapoport on arithmetic cycles for Shimura varieties associated to $U(n-1,1)$. In particular, we establish a relation between the arithmetic degree of certain 0-cycles and the non-singular, non-degenerate, Fourier coefficients of the derivatives of certain incoherent Eisenstein series on $U(n,n)$.

Eva Viehmann

Generalized affine Springer fibres associated to non-equivalued root valuation strata

(joint work with R. Kottwitz) For a given (possibly non-equivalued) root valuation datum we define and study associated generalized affine Springer fibres which are nonempty over the closure of the given root valuation stratum. They define a covering of the generic stratum whose fibres are isomorphic to the subgroup of the affine Weyl group fixing the root valuation datum.

Jean-Loup Waldspurger

An integral formula related to the local Gross-Prasad conjecture

Let F be a p-adic field. We consider the groups $G' = SO(N,F)$ and $G = SO(N+1,F)$ and we suppose given a suitable embedding $G' \to G$. Let π', resp. π, be an admissible irreducible representation of G', resp. G. We define $M(\pi,\pi') = \dim(\mathrm{Hom}_{G'}(\pi,\pi'))$. An old result of Rallis says that $m(\pi,\pi')$ is equal to 0 or 1. Suppose that π is cuspidal and π' is tempered. Then we prove an integral formula that computes $m(\pi,\pi')$ in terms of the characters of π and π'.

Let Π', resp. Π, be an L-packet of tempered representations of G', resp. G (here we use the sophisticated notion of L-packet introduced by Vogan). A weak form of the Gross-Prasad conjecture asserts that there exists a unique pair $(\pi,\pi') \in \Pi \times \Pi'$ such that $m(\pi,\pi') = 1$. Suppose that all the representations in Π are cuspidal and suppose that certain expected properties of L-packets are true. Then our integral formula implies this weak form of the conjecture.

Teruyoshi Yoshida
Remarks on Lubin-Tate theory

We treat a rather simple proof of local class field theory using Lubin-Tate theory, by showing the base change property directly from the Lubin-Tate construction.

Thomas Zink
A de Rham-Witt complex for rigid cohomology

Let X be a smooth scheme over a perfect field k of characteristic $p > 0$. We define a subcomplex of the de Rham-Witt complex of X/k by a certain convergence condition. The hypercohomology of this subcomplex of Zariski sheaves on X tensored with $\mathbb{Q}$ is the rigid cohomology of X. This is joint work with Andreas Langer and Christopher Davis.

Banquet
Universitätsclub
Konviktstr. 9, 53113 Bonn
(close to the boat trip departure point)

B Boat trip
Alter Zoll, Brassertufer

M Mensa (student restaurant)

H1 Hotel Ibis
Vorgebirgsstrasse 33, 72 66 0

H2 Hotel Kurfürstenhof
Baumschulallee 20, 98 50 50

H3 Hotel Löhndorf
Stockenstr. 6, 63 47 26

H4 Hotel Residence
Kaiserplatz 11, 26 97 0

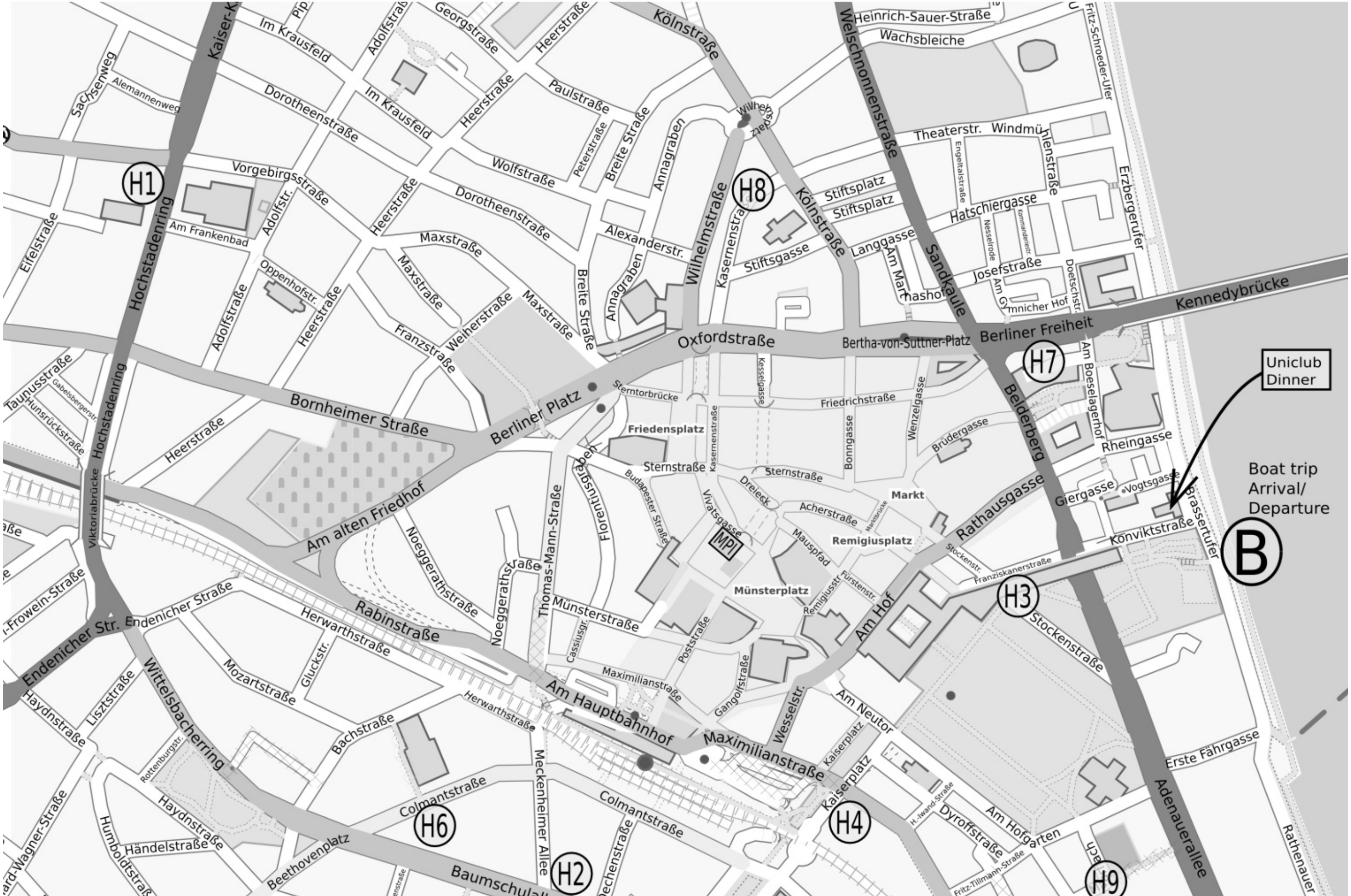
H5 Hotel Krug
Sternenburgstr. 15, 22 58 68

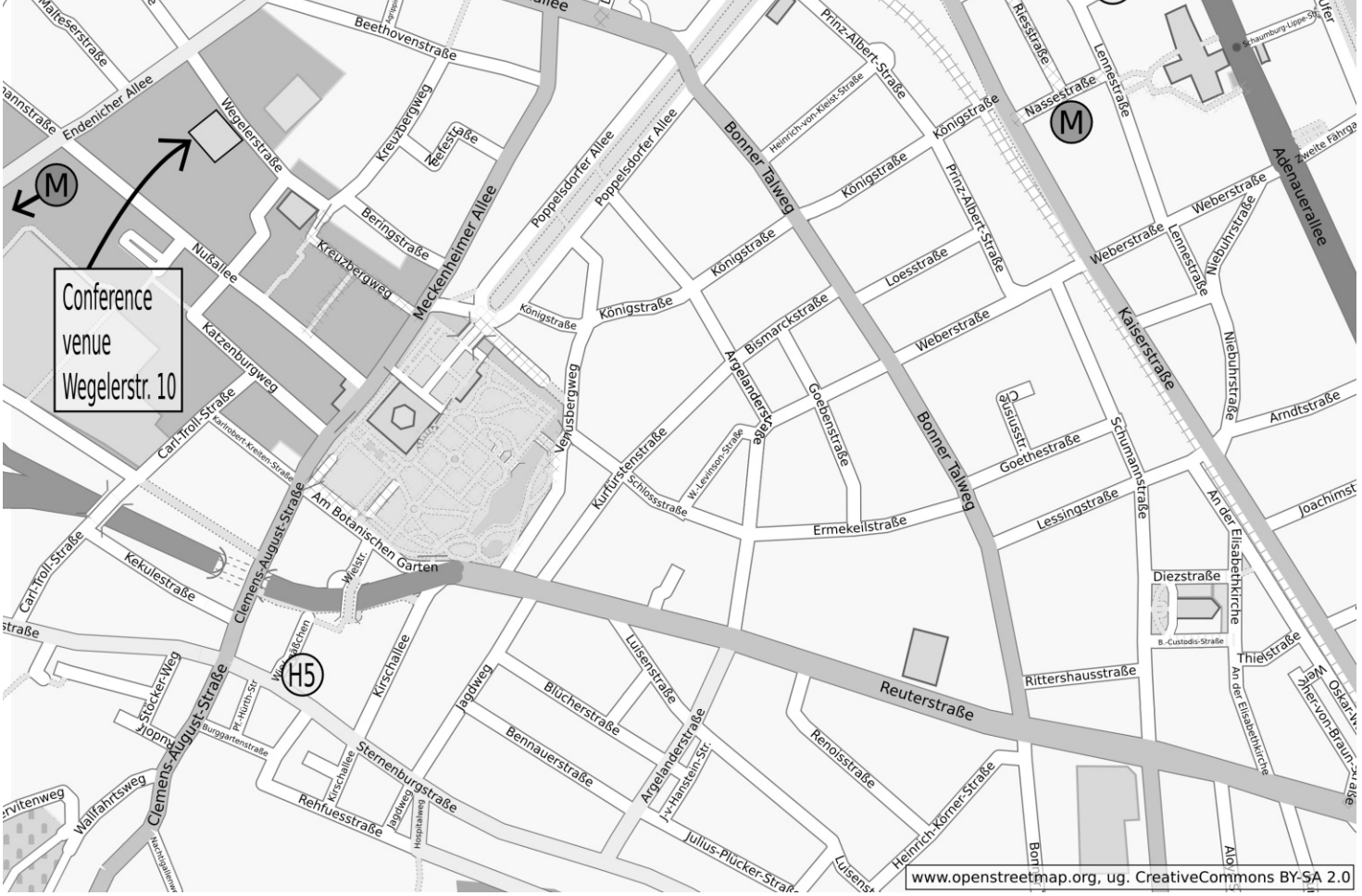
H6 Hotel Esplanade
Colmantstr. 47, 98 38 00

H7 Hotel Rheinland
Berliner Freiheit 11, 90 82 39 0

H8 Hotel Deutsches Haus
Kasernenstr. 19–21, 63 37 77

H9 Hotel Mercedes
Maarflach 17a, 91 80 04 90


Uniclub
Dinner
Boat trip
Arrival/
Departure
B
H1
H2
H3
H4
H6
H7
H8
H9
MPI
Kennedybrücke
Berliner Freiheit
Bertha-von-Suttner-Platz
Oxfordstraße
Berliner Platz
Bornheimer Straße
Am alten Friedhof
Rabinstraße
Am Hauptbahnhof
Maximilianstraße
Kaiserplatz
Adenauerallee
Belderberg
Rathausgasse
Am Hof
Sandkaule
Welschnonnenstraße
Kölnstraße
Wilhelmstraße
Hochstadenring
Wittelsbacherring
Endenicher Str.
Viktoriabrücke
Baumschulallee
Meckenheimer Allee
Colmantstraße
Thomas-Mann-Straße
Münsterstraße
Münsterplatz
Remigiusplatz
Markt
Friedensplatz
Sternstraße
Friedrichstraße
Brassertufer
Konviktstraße
Erzbergerufer
Fritz-Schroeder-Ufer
Rheingasse
Giergasse
Vogtsgasse
Am Boeselagerhof
Franziskanerstraße
Stockenstraße
Erste Fährgasse
Rathenauer
Am Neutor
Am Hofgarten
Dyroffstraße
Wesselstr.
Gangolfstraße
Poststraße
Vivatsgasse
Dreieck
Mauspfad
Acherstraße
Brüdergasse
Wenzelgasse
Bonngasse
Kasernenstraße
Kesselgasse
Sterntorbrücke
Budapester Straße
Florentiusgraben
Noeggerathstraße
Herwarthstraße
Mozartstraße
Gluckstr.
Bachstraße
Haydnstraße
Lisztstraße
Händelstraße
Humboldtstraße
Beethovenplatz
Heerstraße
Maxstraße
Weiherstraße
Franzstraße
Breite Straße
Annagraben
Alexanderstr.
Dorotheenstraße
Wolfstraße
Paulstraße
Peterstraße
Im Krausfeld
Adolfstraße
Georgstraße
Vorgebirgsstraße
Oppenhofstr.
Am Frankenbad
Alemannenweg
Sachsenweg
Eifelstraße
Taunusstraße
Hunsrückstraße
Stiftsplatz
Stiftsgasse
Langgasse
Hatschiergasse
Josefstraße
Theaterstr.
Wachsbleiche
Heinrich-Sauer-Straße
Engeltalstraße
Nesselrode
Doetschstr.


Conference
venue
Wegelerstr. 10
M
H5
Wegelerstraße
Endenicher Allee
Beethovenstraße
Maltheserstraße
Kreuzbergweg
Nepomukstraße
Beringstraße
Nußallee
Katzenburgweg
Carl-Troll-Straße
Kahlbetr-Kneten-Straße
Meckenheimer Allee
Poppelsdorfer Allee
Königstraße
Vemdsbergweg
Kurfürstenstraße
Schlossstraße
W.-Levinson-Straße
Argelanderstraße
Bismarckstraße
Goebenstraße
Bonner Talweg
Prinz-Albert-Straße
Heinrich-von-Kleist-Straße
Rieslstraße
Nassestraße
Lennestraße
Weberstraße
Loesstraße
Niebuhrstraße
Kaiserstraße
Adenauerallee
Arndtstraße
Goethestraße
Schumannstraße
Lessingstraße
Ermekeilstraße
Rittershausstraße
Reuterstraße
Diezstraße
An der Elisabethkirche
Thielstraße
Am Botanischen Garten
Clemens-August-Straße
Kekulestraße
Wiesstr.
Kirschallee
Jagdweg
Blücherstraße
Luisenstraße
Bennauerstraße
Sternenburgstraße
Rehfuesstraße
Julius-Plücker-Straße
Renoisstraße
Heinrich-Körner-Straße
Wallfahrtsweg
Stöcker-Weg
Burggartenstraße
Hospitalweg
Hochsteinallee
Straßburger-Lippe-Straße
Zweite Fahrga
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Lunch & Dinner

Mensa (student cafeteria)

For lunch, the standard solution is the Mensa, a student cafeteria. This is probably the fastest way to have lunch, and also relatively inexpensive. There are two mensa's in walking distance to the math department. The closer one, Mensa Poppelsdorf, is just off the map (but see the marker M with an arrow on the left hand side - it is very close from there). The other one, Mensa Nassestr., is located in the center of Bonn. See the marker M on the right hand side of the map.

Restaurants

There is a large number of restaurants on Clemens-August-Str. (lower left corner of the map), including Italian and Chinese places, a steak house, etc. There are also some restaurants along Königstr., and along Argelanderstr. (i.e. in the area roughly halfway between the conference venue and the mensa Nassestr.).

Wireless LAN

In Wegelerstr. 10, wireless LAN is available. The essential information you need to connect is this:
ESSID: gast-bonnet
Encryption: off
Use DHCP to obtain an IP address.
After connecting, in your browser go to https://gast-bonnet-vb1.rhrz.uni-bonn.de, accept the ssl certificate, and log in with your Benutzerkennung and Passwort, to be found in the flyer. To log off, go to the same page and click the logout button. The flyer contains more detailed information on how to connect with a MS Windows system.

Library

The library of the Mathematisches Institut is located in Wegelerstr. 10 on the third floor. Feel free to use it to look up books or journals, or as a quiet place to work. It is not possible to check out books. In the library, there are a few PCs with internet access which you can use. You do not need an account.

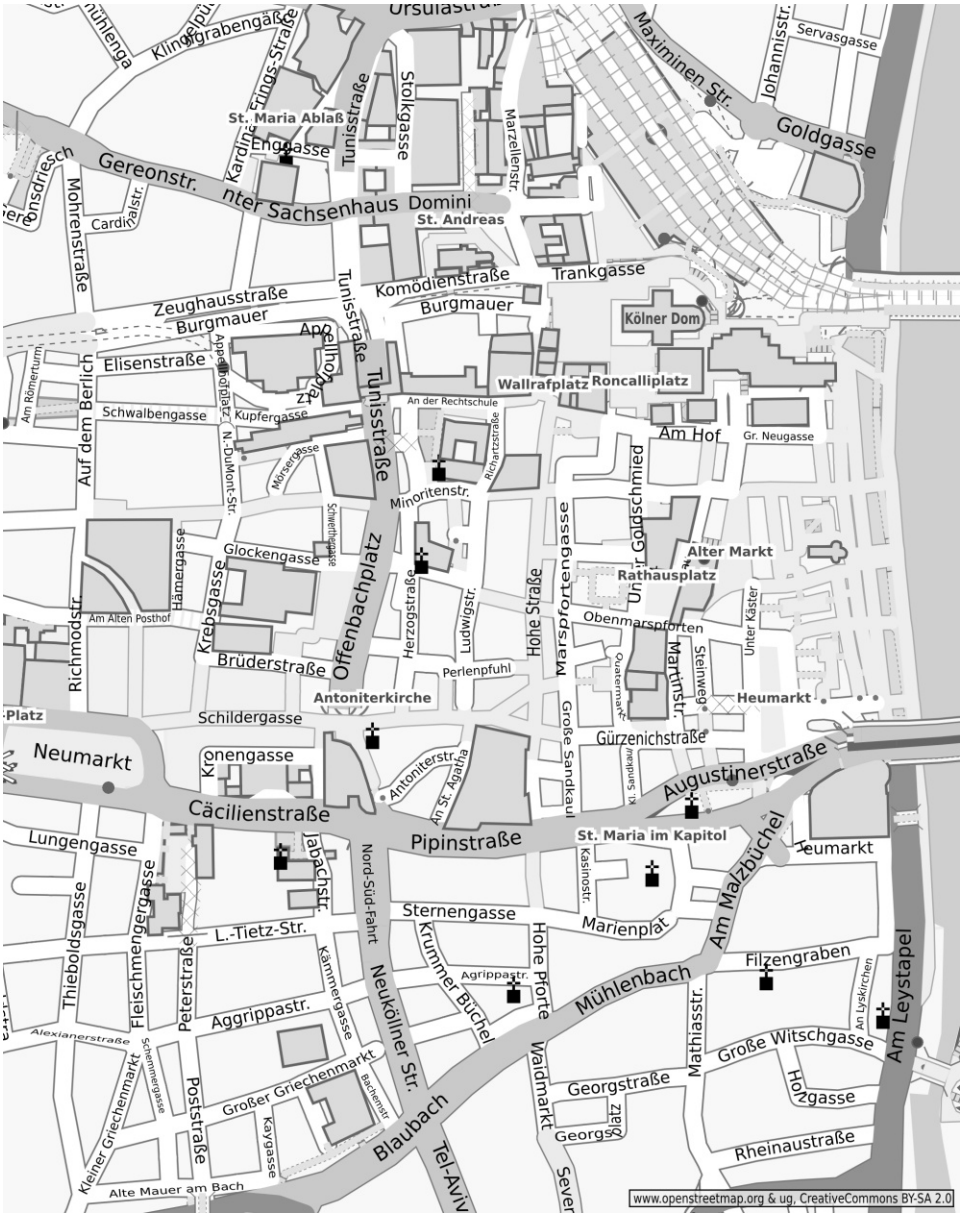
Spending your spare time in Bonn

You find a lot of information about Bonn and the surrounding region in the booklets distributed with the conference documents. In addition, we highlight here the

Botanical Gardens Bonn
If you just want to take a short walk, you could visit the botanical gardens which surround the Poppelsdorfer Schloss, the small castle at the end of Poppelsdorfer Allee. This is very close to the math department. The gardens belong to the oldest ones in Germany, and also have one of the largest selections of different plant species.

Jewish mathematicians in the German-language academic culture
A traveling exposition during the Year of Mathematics in Germany, which will be in Bonn starting Oct. 7 (until Oct. 24). It is located in the Wissenschaftszentrum Bonn, Ahrstr. 45, which can be reached from the center (e.g., from the main station) conveniently by the subway (stop Hochkreuz/Deutsches Museum).

Köln/Cologne



Public transport

The conference venue is just a short walk waya from the hotels H2, H5, and H6. From the other hotels, you can either walk, or take a bus to the main station ("Hauptbahnhof") - please ask at the hotel. From the central bus station, take a bus to "Haydnstr." (on Endenicher Allee), which is very close to Wegelerstr.:

- bus 622, direction "Ückesdorf Mitte", departing from stop E
- bus 623, direction "Lessenich Sportplatz", departing from stop D2
- bus 632, direction "Alfter, Oedekoven Rathaus", departing from stop E
- bus 635, direction "Malteser Krankenhaus", departing from stop D2

The ride will take about 5 minutes. The stop "Beringstr." on Meckenheimer Allee is also quite close to the math department, and can be reached with the bus lines 620, 624, 625.

Excursions

Boat trip, Wednesday afternoon

We leave from "Alter Zoll" (see the map) at 14:30 sharp. The name of the boat is **Poseidon**. We will return around 17:30. Please note that you must register in advance, if you want to join.

Trip to Cologne, Friday afternoon

We will leave from Wegelerstr. at 15:10, i.e. right after the last talk, and take the train at 15:31 from Bonn main station. We will arrive in Cologne around 16:00. The guided tour of the cathedral, for those who signed up for it, will start at 16:30. If there is a significant number of people who prefer to leave for Cologne a little later (and who are not going to join the guided tour), there is the option to take the train at 16:01 from Bonn.

List of participants

Klaus Altmann (FU Berlin)
Amin Azimian (Islamic Azad University)
Peter Barth (Universität Heidelberg)
Elizabeth Beazley (University of Chicago)
Philippe Blanc (Institut de Mathématiques de Luminy)
Don Blasius (UCLA)
David Blottière (Universität Paderborn)
Siegfried Boecherer (Universität Mannheim)
Gebhard Boeckle (Universität Duisburg-Essen)
Jean-François Boutot (Université Louis Pasteur, Strasbourg)
Pascal Boyer (Institut de mathématiques de Jussieu)
Emrah Cakcak (METU)
Henri Carayol (Université Louis Pasteur, Strasbourg)
Xavier Caruso (Université de Rennes 1)
Miaofen Chen (Universite Paris-Sud XI)
Zongbin Chen (Leiden University)
Pierre Colmez (Institut de Mathématiques de Jussieu)
Jean-Francois Dat (Université Pierre et Marie Curie (Paris 6))
Robin De Jong (Mathematical Institute, University of Leiden)
Oleg Demchenko (St.Petersburg State University, Department of Mathematics and Mechanics)
Holger Deppe (Universität Bielefeld)
Jean-Yves Etesse (University of Rennes1)
Gerd Faltings (Max-Planck-Institut für Mathematik Bonn)
Laurent Fargues (Université Paris-Sud)
Elena Fink (Universität Paderborn)
Qendrim Gashi (MPIM Bonn)
Lennart Gehrmann (Universität Bielefeld)
Alain Genestier (Université Nancy)
Eyal Goren (McGill University)

Aaron Greicius (Humboldt-Universität zu Berlin, Institut f. Mathematik)
Harald Grobner (Erwin Schrödinger Institute for Mathematical Physics)
Elmar Grosse-Kloenne (Humboldt Universitaet Berlin)
Ulrich Görtz (Universität Bonn)
Erhan Gürel (Middle East Technical University-NCC)
Thomas Haines (University of Maryland)
Shushi Harashita (Institute for the Physics and Mathematics of the Universe, The University of Tokyo)
Michael Harris (Université Paris 7 Denis Diderot)
Urs Hartl (Westf. Wilhelms-Universität Münster)
Xuhua He (The Hong Kong University of Science and Technology)
Mohammad Hadi Hedayatzadeh (ETH Zürich)
Bernhard Heim (MPI Mathematics, Bonn)
Jochen Heinloth (University of Amsterdam)
Eugen Hellmann (Universität Bonn)
Guy Henniart (Université Paris-Sud)
Henning Hollborn (Universität Mainz)
Daniel Huybrechts (University Bonn)
Fritz Hörmann (Humboldt Universität zu Berlin)
Luc Illusie (Université de Paris-Sud 11)
Junmyeong Jang (Korea institute for advanced study)
Payman Kassaei (King's College London)
Moritz Kerz (Universität Regensburg)
Guido Kings (Universität Regensburg)
Mark Kisin (University of Chicago)
Jan Kohlhaase (Universität Münster)
Robert Kottwitz (University of Chicago)
Martin Kreidl (Mathematisches Institut der Universität Bonn)
Stephen Kudla (University of Toronto)
Herbert Kurke (Humboldt-Universität zu Berlin)
Jean-Pierre Labesse (Institut de Mathématiques de Luminy)
Laurent Lafforgue (Institut des Hautes Études Scientifiques)
Andreas Langer (University of Exeter)

Daniel Larsson (Department of Mathematics, Uppsala University)
Gérard Laumon (Université Paris-Sud)
Mathias Lederer (Universität Bielefeld)
Dong Uk Lee (Korea Institute for Advanced Study)
Ruochuan Liu (Institut de Mathématiques de Jussieu)
Oliver Lorscheid (MPIM Bonn)
Werner Lütkebohmert (Universität Ulm)
Snigdhayan Mahanta (IHES.)
Heinrich Massold
Hartwig Mayer (Humboldt University of Berlin)
Mehran Mehrdad (Max-Planck Institute for mathematics)
Vikram Mehta (Tata Institute of Fundamental Research)
Yoichi Mieda (University of Tokyo)
Andrea Miller (Harvard University)
Stefan Müller-Stach (Johannes Gutenberg Universität Mainz)
Bao Châu Ngô (Institute for Advanced Study)
Marc-Hubert Nicole (IMJ-FA, Paris 7)
Wieslawa Niziol (University of Utah)
Fabrice Orgogozo (CNRS, École polytechnique)
Sascha Orlik (Universität Bonn)
George Pappas (Michigan State University)
Vytautas Paskunas (Uni Bielefeld)
Deepam Patel (University of Munster)
Oliver Petras (Johannes Gutenberg - Universität Mainz)
Richard Pink (ETH Zürich, Switzerland)
Jens Putzka (MPI Bonn/HCM Bonn)
Fatmir Qirezi (Imperial College London)
Michael Rapoport (Universität Bonn)
Walter Ray-Dulany (University of Maryland, College Park)
Markus Reineke (Bergische Universität Wuppertal)
Sean Rostami (University of Maryland, College Park)
Sandra Rozensztajn (UMPA, ENS Lyon)

Morihiko Saito (RIMS Kyoto University)
Julia Sauter (Universität Paderborn)
Alexander Schmitt (Freie Universität Berlin)
Peter Schneider (Mathematisches Institut, Universität Münster)
Peter Scholze (University Bonn)
Joachim Schwermer (University of Vienna / ESI)
Mehmet Haluk Sengun (Univ. of Wisconsin / Univ. of Duisburg-Essen)
Brian Smithling (University of Toronto)
Benoît Stroh (Université Nancy)
Fei Sun (Institut de Mathematique de Jussieu, Universite Paris 6)
Ulrich Terstiege (Universität Bonn)
Ulrich Thiel (TU Kaiserslautern)
Gudlaugur Thorbergsson (Universität zu Köln)
Jacques Tilouine (Université de Paris 13)
Eva Viehmann (Universität Bonn)
Jean-Loup Waldspurger (Institut de Mathématiques de Jussieu)
Torsten Wedhorn (Universität Paderborn)
Kevin Wilson (University of Maryland)
Jean-Pierre Wintenberger (Université Louis Pasteur)
Bora Yalkinoglu (UPMC)
Tonghai Yang (University of Wisconsin)
Teruyoshi Yoshida (Harvard University)
Sarah Livia Zerbes (Imperial College London)
Ernst-Wilhelm Zink (Humboldt-Universität zu Berlin)
Thomas Zink (Universität Bielefeld)
Radoslav Zlatev (Jacobs University Bremen)

	Sun, Oct 5	Mon, Oct. 6	Tue, Oct. 7	Wed, Oct 8	Thu, Oct 9	Fri, Oct 10
8:00-9:00		Registration	Registration			
9:00-10:00		**Colmez**	**Viehmann**	**Ngô**	**Dat**	**Kottwitz**
10:00-10:30		Coffee	Coffee	Coffee	Coffee	Coffee
10:30-11:30		**Waldspurger**	**Henniart**	**Reineke**	**Lafforgue**	**Fargues**
11:45-12:45		**Hartl**	**Pappas**	**Kudla**	**Haines**	**Faltings**

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---		**14:30 - 15:30** Registration		**14:30-17:30** Boat trip		
15:00-15:30		Coffee	Registration/Coffee		Coffee	Coffee
15:30-16:30		**Heinloth**	**Genestier**		**Yoshida**	**15:30 -** Excursion to Cologne
16:45-17:45	**17:00 - 20:00** Registration Wegelerstr. 10	**Zink**	**Harris**		**Kisin**	
---		**17:45-18:15** Registration				
---			**19:00 h-** Banquet			