

Fourth International Workshop on Zeta Functions in Algebra and Geometry

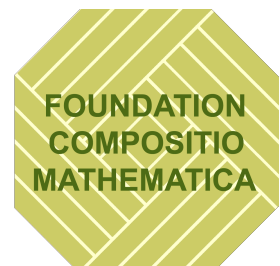
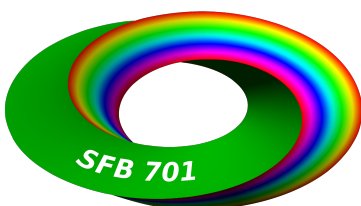
29 May – 02 June 2017

Faculty of Mathematics
Bielefeld University

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

sfb701.math.uni-bielefeld.de/2017_ZFW/

zeta2017@math.uni-bielefeld.de



Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Registration 08:30-08:55 Opening 08:55-09:00				
Pollicott I 09:00-10:00	Raubaut 09:00-10:00	Lemahieu 09:00-10:00	Li 09:00-10:00	Rossmann 09:00-10:00
Coffee & Registration	Coffee	Coffee	Coffee	Coffee
Cluckers 10:30-11:30	Lê 10:30-11:30	Tanimoto 10:30-11:30	Kang 10:30-11:30	Nicaise 10:30-11:30
Cassou-Noguès 11:45-12:45	Xu 11:45-12:45	Loughran 11:45-12:45	Shechter 11:45-12:15	Kionke 11:45-12:45
Lunch @ ZiF	Lunch @ ZiF	Lunch @ ZiF	Lunch @ ZiF	Lunch @ ZiF
Pohl 14:45-15:45	Aizenbud 14:45-15:45	Excursion	Bogner I 14:45-15:45	Onn 14:45-15:45
Coffee	Coffee		Coffee	Coffee
Pollicott II 16:15-17:15	Contributed Talks: Weich, Bocardo 16:15-17:10		Paycha 16:15-17:15	Bogner II 16:15-17:15
		Workshop dinner 19:00-...		

The workshop will take place at the

Center for Interdisciplinary Research (ZiF; www.zif.de)
 Methoden 1
 33615 Bielefeld
 Germany

All talks will take place in the ZiF's central meeting room, the *Plenarsaal*. Lunch will also be served at the ZiF. See Page 19 for directions to the ZiF.

Monday, May 29th

08:30–08:55 **Registration** Also possible during first coffee break

08:55–09:00 **Opening**

09:00–10:00 **Mark Pollicott** (Warwick)

Part 1: Zeta functions and closed geodesics

We describe part of the theory of zeta functions for closed geodesics, beginning with the motivation from number theory, the classical harmonic analysis/trace formula approach to constant curvature surfaces and the dynamical approach to the more general setting of variable negative curvature.

Coffee Break & Registration

10:30–11:30 **Raf Cluckers** (Lille)

Uniform p -adic integration and applications

As a concrete variant of motivic integration, we will discuss uniform p -adic integration and constructive aspects of results involved. Uniformity is in the p -adic fields, and, for large primes p , in the fields $\mathbb{F}_p((t))$ and all their finite field extensions. Using real-valued Haar measures on such fields, one can study integrals, Fourier transforms, etc. We follow a line of research that Jan Denef started in the eighties, with in particular the use of model theory to study various questions related to p -adic integration. A form of uniform p -adic quantifier elimination is used. Using the notion of definable functions, one builds constructively a class of complex-valued functions which one can integrate (w.r.t. some of the variables) without leaving the class. One can also take Fourier transforms in the class. Recent applications in the Langlands program are based on Transfer Principles for uniform p -adic integrals, which allow one to get results for $\mathbb{F}_p((t))$ from results for \mathbb{Q}_p , once p is large, and vice versa. These Transfer Principles are obtained via the study of general kinds of loci, some of them being zero loci. More recently, these loci are playing a role in the uniform study of p -adic wave front sets for (uniformly definable) p -adic distributions, a tool often used in real analysis. This talk contains various joint works with Gordon, Hales, Halupczok, Loeser, Raibaut.

11:45–12:45 **Pierrette Cassou-Noguès** (Bordeaux)

Motivic Milnor fiber at infinity

In this talk, we shall give the main ideas for computing the motivic Milnor fiber at infinity for a polynomial in two variables, using the Newton algorithm. This is a joint work with Michel Raibaut.

Lunch Break

14:45–15:45 **Anke Pohl** (Jena)

Automorphic functions, resonances, and Selberg zeta functions via transfer operators

We report on the current status of a program to develop transfer operator approaches to automorphic functions, resonances, and Selberg zeta functions for non-compact hyperbolic surfaces of finite or infinite area and finite-dimensional representations.

Coffee Break

16:15–17:15 **Mark Pollicott** (Warwick)

Part 2: Zeta functions and higher Teichmüller theory

The Selberg Zeta function $Z(s)$ for Fuchsian groups can be described in terms of representations of (surface) groups in $\mathrm{PSL}(2, \mathbb{R})$. The higher Teichmüller theory can be formulated in terms of representations in $\mathrm{PSL}(d, \mathbb{R})$, for $d > 2$, and we consider how properties of the analogous zeta function compare with those of $Z(s)$.

Tuesday, May 30th

09:00 – 10:00 **Michel Raibaut** (Chambéry)

Motivic invariants at infinity of plane algebraic curves

Let f be a complex polynomial with isolated singularities. In this talk, we will start by recalling classical formulas of the Euler characteristic of a fiber of f in terms of Milnor numbers of the singularities of f and the defect of equisingularity at infinity in a compactification of f . Then, recalling some notions of motivic integration and Denef-Loeser, Guibert-Loeser-Merle theorems, we will consider some motivic zeta functions and define for each value a , a motivic invariant at infinity of the fiber of f at a . This invariant does not depend on the chosen compactification, it is generically equal to zero and, under isolated singularities assumptions, its Euler characteristic is equal to the defect of equisingularity at infinity of f for the value a .

In the last part of the talk, we will consider the case of plane curves, where computations of this invariant can be done in terms of Newton polygons at infinity, using an induction process based on Newton transformations and iterated Newton polygons.

This is a joint work with Pierrette Cassou-Noguès.

Coffee Break

10:30 – 11:30 **Lê Quy Thuong** (Hanoi)

On motivic multiple nearby cycles

We introduce a new product of two formal series with coefficients in distinct Grothendieck rings of algebraic varieties, which preserves the integrability and commutes with the limit of rational series. In the same context, we define a motivic multiple zeta function with respect to an ordered family of regular functions, which is integrable and connects closely to Denef-Loeser's motivic zeta functions. The limit of the motivic multiple zeta function is called the motivic multiple nearby cycles. We will present an explicit formula for the motivic double zeta functions and the motivic double nearby cycles using resolution of singularities. A version of the Euler reflexion formula for motivic double zeta functions will be also given, and by taking its limit the motivic Thom-Sebastiani theorem will be recovered.

11:45 – 12:45 **Chenyang Xu** (Beijing)

Birational models and zeta functions

The progress on birational geometry provides us new tools to study zeta functions via birational models. We will present some results along this line, including the solution of Veys' conjecture (jointly with Johannes Nicaise) and a construction of an alternative motivic zeta function.

Lunch Break

14:45 – 15:45 **Avraham Aizenbud** (Weizmann Institute of Science)

Counting representations of arithmetic groups and point of schemes

We will discuss the following question: How many irreducible representations of a given dimension n do groups like $\mathrm{SL}_d(\mathbb{Z})$ have?

We will see how this question is related to the number of $\mathbb{Z}/n\mathbb{Z}$ -points of certain schemes. Those are related to singularities of moduli spaces, pushforward of smooth measures, commutators of random elements in finite groups, jet schemes and more.

As a result of those connections, we will show that the number of such representations is bounded by a polynomial in n whose degree is universally bounded for high rank arithmetic groups (by 40).

See slides on http://www.wisdom.weizmann.ac.il/~aizenr/4Talks/Rep_count_talk_Glob.pdf

This is a joint project with Nir Avni.

Coffee Break

16:15 – 16:45 **Tobias Weich** (Paderborn)

Classical and quantum resonances on hyperbolic surfaces

It is a classical consequence of Selberg's trace formula, that for compact hyperbolic surfaces the zeros of the Selberg zeta-function are given by the Laplace eigenvalues and by topological zeros. Around 2000 this result has been extended to convex co-compact surfaces by Patterson-Perry and Bunke-Olbrich. In this talk we will see, that behind this correspondence of zeta-zeros and the Laplace spectrum, there is a deeper connection between so called classical and quantum resonant states.

This is joint work with C. Guillarmou (Orsay) and J. Hilgert (Paderborn).

16:50 – 17:10 **Miriam Bocado Gaspar** (Mexico City)

String Amplitudes and Multivariate Local Zeta Functions

In this talk we will give some connections between local zeta functions and p -adic string amplitudes. A main connection is that the convergence of the p -adic Koba-Nielsen type string amplitudes strongly depends on the convergence of Igusa-type integrals with several complex parameters. String amplitudes are "essentially" local zeta functions, and thus, they are algebraic-geometric objects that can be studied over several ground fields, for instance \mathbb{R} , \mathbb{C} , \mathbb{Q}_p , $\mathbb{C}((t))$, and that on each of these fields these objects have similar mathematical properties.

Wednesday, May 31th

09:00 – 10:00 **Ann Lemahieu** (Nice)

On the monodromy conjecture for nondegenerate hypersurface singularities

The monodromy conjecture predicts a relationship between the poles of p -adic integrals associated to a complex polynomial f and the monodromies of the complex hypersurface defined by f . In this talk we will concentrate on the monodromy conjecture at the level of the topological zeta function for hypersurface singularities that are nondegenerate w.r.t. their Newton polyhedron. We explain some partial results in higher dimension and we give a proof of the monodromy conjecture for ‘0-convenient’ singularities in dimension four. This is work in progress with Alexander Esterov (HSE, Moscow) and Kiyoshi Takeuchi (University of Tsukuba, Japan).

Coffee Break

10:30 – 11:30 **Sho Tanimoto** (Copenhagen)

The space of rational curves and height zeta functions

Manin’s conjecture is a conjectural asymptotic formula for the counting function of rational points on a Fano variety after removing the contribution of an exceptional set from the counting function. Recently there are many developments regarding birational geometry of exceptional sets in Manin’s conjecture due to Lehmann-Tanimoto-Tschinkel and Hacon-Jiang. In this talk I would like to explain some of applications of geometry of exceptional sets to the study of the space of rational curves on a Fano variety, and analytic properties of the height zeta function associated to the space of rational curves. This is joint work with Brian Lehmann.

11:45 – 12:45 **Daniel Loughran** (Manchester)

Brauer groups and height zeta functions

In this talk I present some results on a problem of Serre concerning specialisations of Brauer groups on algebraic varieties.

Lunch Break

Excursion

19:00 – **Workshop dinner**

Thursday, June 1st

09:00 – 10:00 **Wen-Ch'ing Li** (Pennsylvania State)

Group based combinatorial zeta functions

Similar to their counterparts in number theory, a combinatorial zeta function counts the geodesic closed cycles in a finite simplicial complex. In this survey talk we shall consider the complexes arising from finite quotients of buildings. The properties of such zeta functions will be discussed, and connection and comparison with number theoretical zeta functions will be mentioned.

Coffee Break

10:30 – 11:30 **Ming-Hsuan Kang** (Hsinchu)

Geometric zeta functions on reductive groups over non-archimedean local fields

Ihara zeta functions is a geometric zeta function associated to a finite quotient of the building of PGL_2 over a non-archimedean local field. In this talk, we will study geometric zeta functions on Tits buildings of split reductive groups of higher ranks via two different tools and the philosophy of the field with one element. For groups of adjoint type, we will first study the relation between Langlands L -functions and geometric zeta functions on a single apartment and then establish the result to the whole building. For simply connected groups, we will study zeta function using generalized Poincaré series associated to Iwahori Hecke algebra. Especially, our method can be applied to all groups of rank two including G_2 .

11:45 – 12:15 **Shai Shechter** (Be'er Sheva)

On regular characters of classical groups

Regular characters of $G = \mathrm{GL}_n(\mathfrak{o})$, where \mathfrak{o} is a discrete valuation ring, form a considerable subset of the set of irreducible complex continuous characters of G and the largest class currently amenable to explicit construction. The definition of regular characters goes back to Shintani and Hill, who proved a variety of favourable properties of such characters and completed their construction in several key cases. Recently, the construction of all regular characters of $\mathrm{GL}_n(\mathfrak{o})$ was completed by Stasinski and Stevens and, independently, by Krakowski, Onn and Singla, who also computed the regular representation zeta function of the special and unitary groups over \mathfrak{o} , i.e. the Dirichlet series $\zeta^{\mathrm{reg}}(s) = \sum \chi(1)^{-s}$, where χ ranges over all regular characters of G .

In my talk, I will report on a generalization of the definition and construction of regular characters to the classical groups over \mathfrak{o} .

Lunch Break

14:45 – 15:45 **Christian Bogner** (HU Berlin)
Part 1: Periods and Feynman integrals

In particle physics, many computations rely on the evaluation of so-called Feynman integrals. It is well-known that zeta values, multiple zeta values and generalizations of polylogarithms appear very frequently in these computations. Over the last decade, a new mathematical perspective on Feynman integrals was established in which these integrals are related to period integrals in the sense of algebraic geometry. In this talk I give a brief introduction to Feynman integrals and review some of their relations to multiple zeta values and periods in general.

Coffee Break

16:15 – 17:15 **Sylvie Paycha** (Potsdam)
Branched zeta functions and their renormalised values at poles

Multizeta functions generalise the well-known ordinary zeta function and branched zeta functions are discrete sums attached to trees that generalise multizeta functions which correspond to ladder trees. We view branched zeta functions as discrete sums of pseudodifferential symbols and accordingly, we decorate the trees with pseudodifferential symbols. We then implement a multivariate regularisation procedure in replacing the symbols in the decoration by holomorphic families of symbols. Using the universal property of trees, we then build the corresponding regularised branched zeta functions and show that they are *multivariate meromorphic functions with linear poles*.

In order to renormalise branched zeta functions at poles, we need a good control of the poles. For this purpose, we use a refined universal property for trees, which involves the notion of locality, reminiscent of locality in quantum field theory. In our framework locality is encoded in a binary symmetric relation, with which we equip sets that we call localised sets. We introduce the localised monoid of properly decorated forests, which serves as a model for what we call *partially operated localised monoids*. A refined universal property for partially operated localised monoids provides us with a good knowledge of the pole structure of the branched zeta functions. Branched zeta functions are then renormalised at poles using a multivariate minimal subtraction scheme, which generalises the (univariate) minimal subtraction scheme known to physicists. This talk is based on joint work with Pierre Clavier, Li Guo and Bin Zhang.

Friday, June 2nd

09:00 – 10:00 **Tobias Rossmann** (Auckland)

The average size of the kernel of a matrix and orbits of linear groups

Given a module M of matrices over a compact discrete valuation ring \mathcal{O} of characteristic zero, we consider the generating function encoding the average sizes of the kernels of the elements of M over the finite quotients of \mathcal{O} . As we will see, special cases of these generating functions include conjugacy class and orbit-counting zeta functions of suitable groups.

Coffee Break

10:30 – 11:30 **Johannes Nicaise** (London)

A motivic Fubini theorem for the tropicalization map

This talk is based on joint work with Sam Payne. I will present a Fubini theorem for the tropicalization map in the context of Hrushovski and Kazhdan's theory of motivic integration. As an application, I will prove a conjectural description by Davison and Meinhardt of the motivic nearby fiber of a weighted homogeneous polynomial. This conjecture emerged in the theory of motivic Donaldson-Thomas invariants. The same method yields a short proof of the integral identity conjecture of Kontsevich and Soibelman, which was proven by Lê Quy Thuong.

11:45 – 12:45 **Steffen Kionke** (Düsseldorf)

Zeta functions associated to representations of compact p -adic Lie groups

To an admissible smooth representation of a profinite group we associate a zeta function defined via a Dirichlet series which encodes the multiplicities and degrees of the irreducible constituents. This provides a new perspective on the well-known 'representation zeta function' of (profinite) groups. We give a short introduction to the topic and explain how this approach can yield a more detailed understanding of problems in the area of representation growth. In particular, we discuss induced representations of compact p -adic Lie groups (e.g. the general linear group over the p -adic integers). In this case the zeta functions can be related to certain series of Igusa integrals and classical methods can be used to prove rationality and functional equations. This is based on joint work with Benjamin Klopsch.

Lunch Break

14:45–15:45 **Uri Onn** (Be'er Sheva)

Pro-isomorphic zeta functions of some D^ -groups*

Pro-isomorphic zeta functions are Dirichlet series associated with finitely generated nilpotent groups that enumerate finite index subgroups having the same finite quotients as the parent group. They constitute one of the natural non-commutative analogues of the classical Dedekind zeta functions. While other analogues, such as (normal) subgroup zeta functions, have been studied intensively, the study of pro-isomorphic zeta functions is in a far less advanced state. A unique feature of the latter is that they are closely related to zeta functions of algebraic groups, studied by Weil, Igusa and others. In this talk I will describe the main tools that are used to study pro-isomorphic zeta functions and report on some recent results regarding zeta functions associated with members of a family of class-2 nilpotent groups called D^* -groups. This is a joint work with Mark Berman and Benjamin Klopsch.

Coffee Break

16:15–17:15 **Christian Bogner** (HU Berlin)

Part 2: Algorithms for multiple polylogarithms

Multiple polylogarithms and multiple zeta values serve as a useful framework of functions and numbers for the computation of many Feynman integrals. They can be expressed in terms of a particular class of iterated integrals on moduli spaces of curves. In this talk I discuss algorithms for computations with these iterated integrals and present a resulting computer program whose main purpose is the evaluation of a certain class of Feynman integrals. I will also refer to other possible applications of this program.

List of participants

Avraham Aizenbud	Weizmann Institute of Science, Israel
Tomer Bauer	Bar-Ilan University
Michael Baake	Universität Bielefeld
Miriam Bocardo	CINVESTAV, Mexico
Christian Bogner	Humboldt-Universität zu Berlin
Benjamin Brück	Universität Bielefeld
Antonio Campillo	Valladolid University
Angela Carnevale	Universität Bielefeld
Pierrette Cassou-Noguès	Université de Bordeaux
Thomas Cauwbergs	Universität Bielefeld
Leonardo Chacón	(Universidad Pontificia Javeriana Bogotá-Colombia)
Saskia Chambille	KU Leuven and Université de Lille 1
René Chipot	University of Basel and University of Grenoble
Raf Cluckers	Université de Lille 1
Ferran Dachs-Cadefau	Universitat Halle
Alexander Felshtyn	University of Szczecin
Oihana Garaialde Ocaña	Heinrich-Heine Universität Düsseldorf
Pedro Gonzalez Perez	ICMAT and Universidad Complutense de Madrid
Sabir Gusein-Zade	Moscow State Lomonosov University
Joachim Hilgert	Universität Paderborn
Takeo Kamizawa	Nicolaus Copernicus University
Ming-Hsuan Kang	National Chiao Tung University
Ann Kiefer	Universität Bielefeld
Steffen Kionke	Heinrich-Heine-Universität Düsseldorf
Benjamin Klopsch	Heinrich-Heine-Universität Düsseldorf
Quy Thuong Lê	Hanoi University of Science
Seungjai Lee	National Institute for Mathematical Sciences, South Korea
Ann Lemahieu	Université Nice Sophia Antipolis
Edwin León-Cardenal	CIMAT, Mexico
Winnie Li	The Pennsylvania State University
Paula Lins	Universität Bielefeld
Alastair Litterick	Ruhr-Universität Bochum
Daniel Loughran	University of Manchester
Alejandro Melle-Hernández	Complutense University of Madrid
Johannes Nicaise	Imperial College London
Uri Onn	Ben-Gurion University of the Negev
Sylvie Paycha	Universität Potsdam
Emilio Pierro	Universität Bielefeld
Anke Pohl	Friedrich-Schiller-Universität Jena
Mark Pollicott	University of Warwick
Michel Raibaut	Université Savoie Mont Blanc
Matthias Riepe	Heinrich-Heine-Universität Düsseldorf
Tobias Rossmann	University of Auckland
Sezgin Sezer	Okan University
Muhammad Shabbir	Universität zu Lübeck
Shai Shechter	Ben-Gurion University, Israel
Pavel Solomatin	Leiden University

Mima Stanojkovski	Leiden University
Diego Sulca	Universidad Nacional de Córdoba
Dmitry Sustretov	Université de Lille 1
Sho Tanimoto	University of Copenhagen
Jean-Louis Verger-Gaugry	Université Savoie Mont Blanc
Wim Veys	KU Leuven
Charles Vial	Universität Bielefeld
Christopher Voll	Universität Bielefeld
Lena Vos	KU Leuven
Polina Vytnova	University of Warwick
Tobias Weich	Universität Paderborn
Lin Weng	Kyushu University
Stefan Witzel	Universität Bielefeld
Chenyang Xu	Beijing International Center of Mathematics Research
Michele Zordan	KU Leuven
Wilson Zúñiga-Galindo	CINVESTAV, Mexico

Local information

Emergency telephone numbers

Police: **110**. Fire and rescue services: **112**.

Contact

The local organizers may be contacted via email (zeta2017@math.uni-bielefeld.de).

Online map

A google map with some of the mentioned locations is available at

<https://drive.google.com/open?id=1cDbdaOLmq8N-cPVbrINE90mq53w&usp=sharing>

Leineweber-Market

Sunday, May 28th is the last day of the Leineweber-Market, a fair in the centre of town. It closes at 10 pm.

Food and drink

Here is a selection of Bielefeld's numerous bars, cafes and restaurants, with some partial indication on the price range (€–€€€). Beware that not all places accept credit cards.

- BAR 383, Karl-Eilers-Str. 20a
- Zwanzig Dreizehn Bar & Cuisine, Klosterplatz 13
- (€€) Numa, Obernstraße 26
- (€€–€€€) Bernstein, Niederwall 2
- (€€) Kachelhaus, Hagenbruchstr. 13
- (€€) Brauhaus Joh. Albrecht, Hagenbruchstr. 8
- (€€) Wernings Weinstube, Alter Markt 1
- (€€€) Klötzers Kleines Restaurant, Niedernstr. 41
- (€€) Der Koch, Rolandstr. 15
- (€€–€€€) Vin pur – Heinrich sein Enkel, Rolandstr. 20 (wine bar, cafe, light meals)
- (€) Piro, Mercatorstr. 13 - 15
- (€) Univarza, in the University's main building

Weekends

Most shops, including grocery stores and supermarkets, will be closed on Sunday. Some convenience stores and petrol stations might sell food. Most restaurants and cafes should be open.

ATM, postal services, grocery shop, book store

Bielefeld's central Post Office is located in Nahariyastr. 1, not far from the central station. In the University's main building, which is quite close to the ZiF, you will find

- the ATMs of Sparkasse, a local bank,
- the grocery shop 'Eddy in der Uni',
- the book store with post office 'Luce Buchhandlung in der Uni Bielefeld'

Supermarkets

- Combi, Wertherstr. 266
- Aldi, Große-Kurfürsten-Str. 82
- EDEKA, Große-Kurfürsten-Str. 66
- REWE, August-Bebel-Str. 116
- REAL, Teutoburger Str. 98

Leisure and sports; excursion

There are a number of footpaths from the ZiF into the *Teutoburger Wald*, a range of wooded hills, making for ideal walking and running tracks. In fact, the nicest way from the ZiF to the city centre is a walk of around 50 minutes through the woods.

The excursion on Wednesday afternoon will be a guided walk through the countryside south-west of the ZiF. It will end at the *Bauernhausmuseum*, a small open air exhibition of historical buildings (<http://www.bielefelder-bauernhausmuseum.de/>), or rather the small café on its premises.

Alternatives include Bielefeld's *Historisches Museum* (www.historisches-museum-bielefeld.de/), which documents the city's manufacturing resp. industrial heritage. The *Kunsthalle* (www.kunsthalle-bielefeld.de/?lang=en) is a small but not unappealing art centre in the centre of town (and home of an interesting café, too).

There is a public swimming pool not far from the central station (www.ishara.de/).

German survival guide

Do you speak English?	Sprechen Sie Englisch?		
How are you?	Wie geht es Ihnen?		
Would you help me please?	Würden Sie mir bitte helfen?	0	null
What's your name?	Wie heißen Sie?	1	eins
What time is it?	Wie viel Uhr ist es?	2	zwei
What's the weather like?	Wie ist das Wetter?	3	drei
How much does . . . cost?	Wie viel kostet . . . ?	4	vier
Where do I find . . . ?	Wo finde ich . . . ?	5	fünf
Where are the bathrooms?	Wo sind die Toiletten?	6	sechs
Do you have . . . ?	Haben Sie . . . ?	7	sieben
Where is . . . ?	Wo ist . . . ?	8	acht
Could you please talk more slowly?	Könnten Sie bitte langsamer sprechen?	9	neun
Could you repeat that, please?	Könnten Sie das bitte wiederholen?	10	zehn
Hello!	Hallo!	11	elf
Good day!	Guten Tag!	12	zwölf
Good evening!	Guten Abend!	13	dreizehn
Good-bye!	Auf Wiedersehen!	14	vierzehn
Please./You're welcome.	Bitte.	15	fünfzehn
Thank you.	Danke.	16	sechzehn
Sorry.	Entschuldigung.	17	siebzehn
My name is . . .	Ich heiße . . .	18	achtzehn
Pleased to meet you.	Freut mich.	19	neunzehn
Help!	Hilfe!	20	zwanzig
Police!	Polizei!	21	einundzwanzig
Fire!	Feuer!	22	zweiundzwanzig
Get a doctor!	Holen Sie einen Arzt!	30	dreißig
I am ill.	Ich bin krank.	40	vierzig
I don't know my way around here.	Ich kenne mich hier nicht aus.	50	fünfzig
The menu, please.	Die Speisekarte bitte.	60	sechzig
I'd like . . .	Ich hätte gern . . .	70	siebzig
Could you recommend something?	Könnten Sie etwas empfehlen?	80	achtzig
Another (beer) please.	Noch (ein Bier) bitte.	90	neunzig
Excuse me.	Entschuldigen Sie bitte.	100	(ein)hundert
The bill, please.	Die Rechnung bitte.	200	zweihundert
A receipt, please.	Eine Quittung bitte.	1000	tausend
Enjoy your meal.	Guten Appetit.		

Getting to the ZiF – public transport in Bielefeld

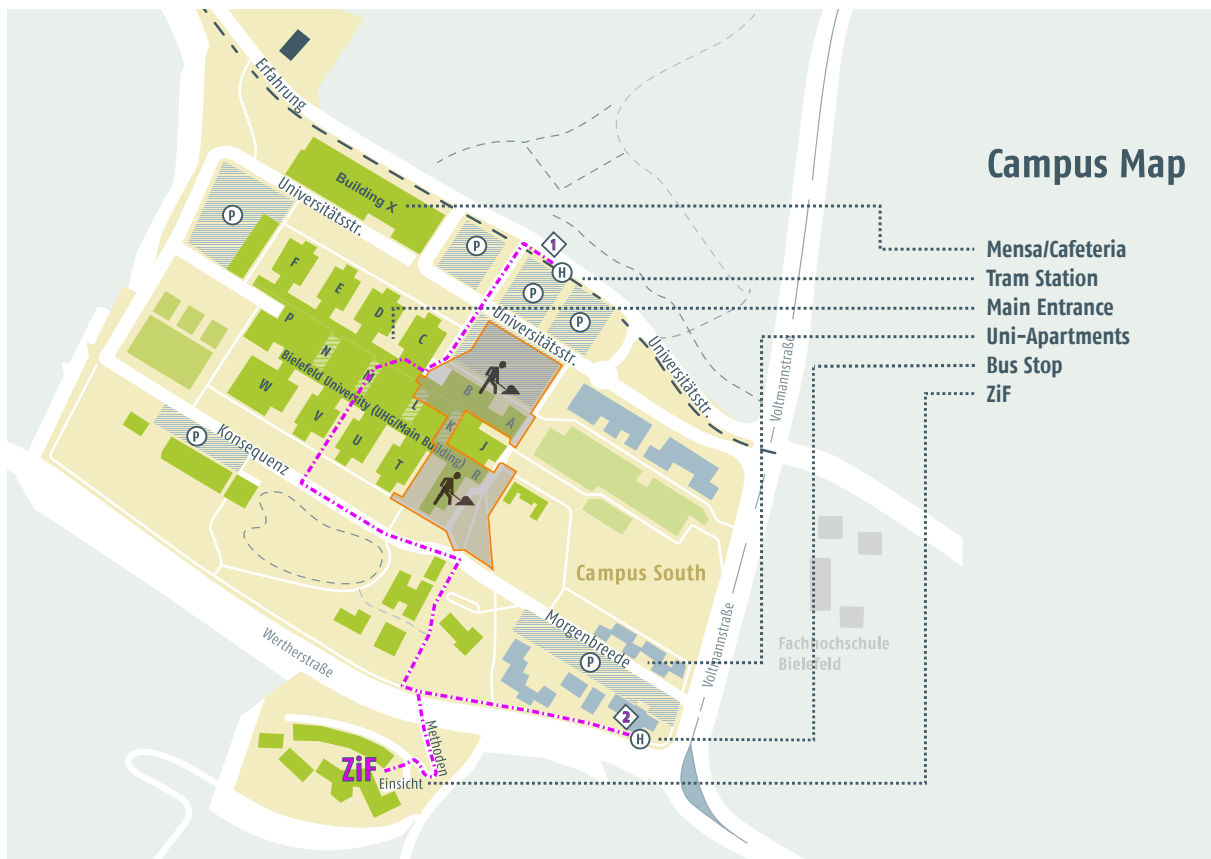
Public transport in Bielefeld is run by *moBiel*; see www.mobiel.de for timetables and ticket options.

- **Ticketing** For a single ride between the centre of town and the ZiF you will need a ticket (*Fahrschein*) in the fare-zone *Preisstufe 1 BI*. A single such ticket costs EUR 2.50. A more economical option is to buy a *4er Ticket*, comprising four individual tickets, for € 8.40. Tickets need to be validated for each trip; this can be done within busses and/or tramways. You can validate tickets for several people on a single *4er Ticket*. Tickets are on sale, in particular, from machines at tramway stations, but not inside tramways.
- **Tram (Stadtbahn)** Bielefeld is served by the *Stadtbahn*, a tramway. The relevant line for the workshop is Line no. 4 (marked in red on the map overleaf), its relevant stops include
 - Rathaus (closest to Arcadia Hotel),
 - Jahnplatz (closest to aappartел boardinghouse),
 - Hauptbahnhof (= central station, closest to B&B and Kolpinghaus),
 - Bültmannshof (closest to the ZiF),
 - Universität (most straightforward for the ZiF).

Trams towards the ZiF will head for *Lohmannshof* or *Universität*, those towards the centre of town will have *Rathaus* as their destination.

- **Bus** The ZiF can also be reached, at least as quickly and easily, by bus. Bus lines 21, 61 and 62 serve the nearby stop *Uni/Stud.-Wohnheim*.
 - Bus line 21 departs from *Jahnplatz* (ideal for those staying at aappartел boardinghouse or Arcadia Hotel) with destination *Werther Gesamtschule* towards the ZiF.
 - Bus lines 61 and 62 depart from *Hauptbahnhof* (ideal for those staying at the B&B or the Kolpinghaus) with directions *Borholzhausen* or *Schützenhaus* towards the ZiF.

The local organizing team will be happy to assist with any questions you may have!



Tram map

