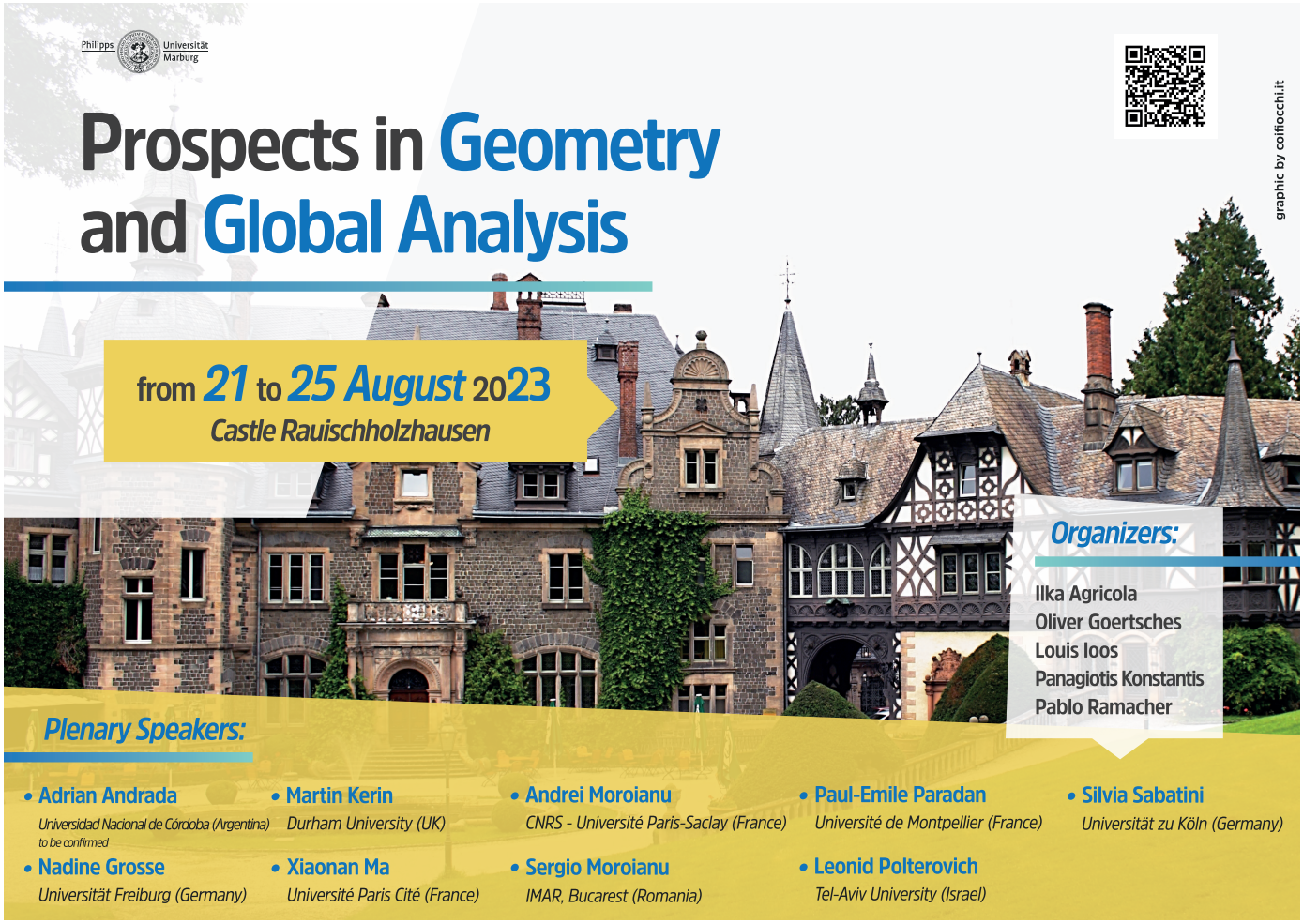


Conference Booklet

Contents

Timetable

Monday, 21 August 2023

09:00 - 09:50	**Polterovich**	*Courant, Bezout, and topological persistence*
09:50 - 10:30	**Coffee**	
10:30 - 11:20	**Große**	*Boundary value problems on singular domains*
11:30 - 12:00	**Guimarães**	*The κ-nullity of Riemannian manifolds and their splitting tensors*
12:00 - 14:00	**Lunch**	
14:00 - 14:50	**Rot**	*Non-linear Fredholm mappings and stable homotopy groups of spheres*
15:00 - 15:30	**Marouani**	*Hyperbolicity in the non-Kähler context of compact complex manifolds*
15:30 - 16:00	**Coffee**	
16:00 - 16:50	**Ma**	*Eta-invariant and localisation*
19:00	**Dinner**	

Tuesday, 22 August 2023

09:00 - 09:50	**A. Moroianu**	*Locally conformally product structures*
09:50 - 10:30	**Coffee**	
10:30 - 11:20	**Istrati**	*Vaisman manifolds with vanishing first Chern class*
11:30 - 12:00	**Zoller**	*Domination of manifolds and formality*
12:00 - 14:00	**Lunch**	
14:00 - 14:50	**Dileo**	*On the classification of almost contact metric manifolds*
15:00 - 15:30	**Di Pinto**	*On the geometry of anti-quasi-Sasakian manifolds*
15:30 - 16:00	**Coffee**	
16:00 - 16:30	**Jahnke**	*Left-invariant involutive structures on compact Lie groups*
19:00	**Dinner**	

Wednesday, 23 August 2023

09:00 - 09:50	**Sabatini**	*Monotone (tall) complexity one spaces*
09:50 - 10:30	**Coffee**	
10:30 - 11:20	**Paradan**	*Moment polytopes in real symplectic geometry*
11:30 - 12:00	**Wardenski**	*Multiplicity-free U(2)-manifolds*
12:00	**Lunch**	
19:00	**Dinner**	

Thursday, 24 August 2023

09:00 - 09:50	**S. Moroianu**	*The Gauss-Bonnet formula on polyhedral manifolds*
09:50 - 10:30	**Coffee**	
10:30 - 11:20	**Kerin**	*Double disk bundles*
11:30 - 12:00	**Henkel/Naujoks**	*The Geometry of Aloff-Wallach Spaces*
12:00 - 14:00	**Lunch**	
14:00 - 14:50	**Ferreira**	*Geodesic completeness of pseudo-Riemannian Lie groups*
15:00 - 15:30	**Hoffmann**	*Special Spinors on Homogeneous Spaces*
15:30 - 16:00	**Coffee**	
16:00 - 16:50	**Belgun**	*Special Riemannian and Weyl holonomy*
19:00	**Dinner**	

Friday, 25 August 2023

09:00 - 09:50	**Winther**	*Minimal Projective Orbits of Semi-simple Lie Groups*
09:50 - 10:30	**Coffee**	
10:30 - 11:20	**Stecker**	*Canonical Submersions in Nearly Kähler Geometry*
11:30 - 12:00	**Schoemann**	*The kernel of the Gysin homomorphism on Chow groups of zero cycles*
12:00 - 14:00	**Lunch**	
14:00 - 14:50	**Bazzoni**	G_2 *structures on nilmanifolds and their moduli spaces*
16:00	**Bus departure**	
19:00	**Dinner (only for those who are staying until Saturday morning)**	

Abstracts

Monday 21st

Courant, Bezout, and topological persistence

L. Polterovich
Tel Aviv University

I'll discuss generalizations of two classical results, Courant's nodal domain theorem and Bezout's theorem, based on ideas of topological data analysis. Joint with Lev Buhovsky, Jordan Payette, Iosif Polterovich, Egor Shelukhin, and Vukašin Stojisavljević.

Boundary value problems on singular domains

N. Große
University of Freiburg

We consider boundary value problems of the Laplacian with Dirichlet (or mixed) boundary conditions on domains with singularities. In two dimensions these singularities include also cusps. Our approach is by blowing up the singularities via a conformal change to translate the boundary problem to one on a noncompact manifold with boundary that is of bounded geometry and of finite width. This gives a natural geometric interpretation in the appearing weights and additional conditions needed to obtain well-posedness results. This is joint work with Bernd Ammann (Regensburg) and Victor Nistor (Universite de Lorraine).

The κ-nullity of Riemannian manifolds and their splitting tensors

F. Guimarães
KU Leuven

We consider Riemannian n-manifolds M with nontrivial κ-nullity "distribution" of the curvature tensor R, namely, the variable rank distribution of tangent subspaces to M where R coincides with the curvature tensor of a space of constant curvature κ ($\kappa \in \mathbb{R}$) is nontrivial. We obtain classification theorems under different additional assumptions, in terms of low nullity/conullity, controlled scalar curvature or existence of quotients of finite volume. We prove new results, but also revisit previous ones. This is a joint work with Claudio Gorodski.

Non-linear Fredholm mappings and stable homotopy groups of spheres

T. Rot
Vrij Universiteit Amsterdam

Many elliptic PDE problems can be described as zero finding problems of non-linear proper Fredholm mappings $f : H \to H$, where H is an infinite dimensional Hilbert space. In this talk I will classify these mappings up to homotopy in terms of a non-trivial quotient of the stable homotopy groups of spheres. This is joint work with Lauran Toussaint.

Hyperbolicity in the non-Kähler context of compact complex manifolds

S. Marouani
Paul Sabatier University

Abstract: The main objective of this presentation is to introduce a new notion of hyperbolicity for compact complex manifolds, not necessarily Kähler, which lies between Kähler hyperbolicity in the sense of Gromov and Brody/Kobayashi hyperbolicity.

Eta-invariant and localisation

X. Ma
Université Paris Cité

The eta-invariant was introduced in the 1970's by Atiyah-Patodi-Singer as the boundary contribution of index theorem for compact manifolds with boundary. It is not computable in a local way and not a topological invariant. When there is group action, we can define the equivariant eta-invariants.

In this talk, we will give a general introduction on eta-invariants, and we will explain our joint work with Bo Liu: a localization formula for equivariant eta-invariants,i.e., understand the equivariant eta-invariant via the contribution of the fixed point sets of the group action.

Tuesday, 22nd

Locally conformal product structures

A. Moroianu
Université Paris-Saclay

An LCP manifold is a quotient of a reducible simply connected Riemannian manifold by a discrete co-compact group of homotheties, not all of which being isometries. Every LCP manifold is compact but does not carry a natural Riemannian metric. Instead, it is endowed with a conformal structure, and a closed non-exact reducible Weyl connection. We will discuss their basic properties, with emphasis on the analogy with LCK manifolds, and explain the classification of low-dimensional LCP solvmanifolds. The talk is based on joint work with Andrada, Belgun, del Barco and Pilca.

Vaisman manifolds with vanishing first Chern class

N. Istrati
Philipps-Universität Marburg

Vaisman manifolds are a special class of locally conformally Kähler manifolds, whose geometry is closely related to the Kähler world. When their first Chern class vanishes, they exhibit different behaviour, depending on the sign of a refined characteristic class. I will describe this behaviour in comparison to the Kähler context. In particular, I will discuss the existence of canonical Vaisman metrics, their automorphism group and their small deformations.

Domination and formality

L. Zoller
Ludwig-Maximilians-Universität München

If there is a non-zero degree map between closed manifolds, then we say that the domain dominates the target. A general heuristic claims that in this case the target is "not more complicated" than the domain. A manifold is formal if its de Rham algebra is of the simplest quasi-isomorphism type with a given cohomology. We prove that indeed this notion of simplicity is inherited under the relation of domination. This is joint work with A. Milivojevic and J. Stelzig.

On the classification of almost contact metric manifolds

G. Delio
Università degli Studi di Bari Aldo Moro

I will review general properties of almost contact metric manifolds, including the Chinea- Gonzalez classifying criterion. For a large class of almost contact metric manifolds, called H-parallel, I will show that the Chinea-Gonzalez classification can be reinterpreted in terms of two characteristic tensor fields. The same tensor fields are involved in the description of geometric properties, such as CR-integrability, normality, and anti-normality. The intrinsic torsion of an H-parallel almost contact metric manifold can be also expressed by means of the two characteristic tensor fields. This is a joint work with I. Agricola, D. Di Pinto, M. Kuhrt.

On the geometry of anti-quasi-Sasakian manifolds

D. Di Pinto
Università degli Studi di Bari Aldo Moro

Introduced by D.E. Blair as a generalization of both Sasakian and cokähler manifolds, quasi-Sasakian manifolds are defined as normal almost contact metric manifolds $(M, \varphi, \xi, \eta, g)$, with closed fundamental 2-form Φ. The Reeb vector field ξ is Killing, the structure (φ, g) is projectable along the 1-dimensional foliation generated by ξ, and the transverse geometry is Kähler.

In the present talk I will introduce a new class of almost contact metric manifolds $(M, \varphi, \xi, \eta, g)$, defined in such a way that the structure (φ, g) is still projectable, and the transverse geometry with respect to ξ is given by a Kähler structure endowed with a closed $(2,0)$-form. Hyperkähler manifolds are well known examples of Kähler manifolds with a nondegenerate closed $(2,0)$-form. In order to introduce the new class, one needs to modify the normality condition into an *anti-normal* condition. Precisely, an *anti-quasi-Sasakian manifold* (aqS for short) is defined as an almost contact metric manifold $(M, \varphi, \xi, \eta, g)$ such that

$$d\Phi = 0, \qquad N_\varphi = 2d\eta \otimes \xi.$$

Various examples of aqS manifolds can be provided, including compact nilmanifolds and $\mathbb{S}^1$-bundles. I will discuss general properties of aqS manifolds, focusing on the Riemannian curvature. In particular, aqS manifolds with constant ξ-sectional curvature equal to 1 will be characterized: they admit a $Sp(n) \times 1$-reduction of the structural group of the frame bundle, such that the manifold is +transversely hyperkähler, carrying a second aqS structure and a null Sasakian η-Einstein structure. I will also present some obstructions to the existence of aqS structures, one of them stating that aqS manifolds with constant sectional curvature are necessarily flat and cokähler. This is a joint work with Giulia Dileo (Bari).

Levi-flat CR structures on compact Lie groups

M. Jahnke
Philipps-Universität Marburg

Pittie (Proc Indian Acad Sci Math Sci 98:117-152, 1988) proved that the Dolbeault cohomology of all left-invariant complex structures on compact Lie groups can be computed by looking at the Dolbeault cohomology induced on a conveniently chosen maximal torus. We generalized Pittie's result to left-invariant Levi-flat CR structures of maximal rank on compact Lie groups. The main tools we used was a version of the Leray–Hirsch theorem for CR principal bundles and the algebraic classification of left-invariant CR structures of maximal rank on compact Lie groups (Charbonnel and Khalgui in J Lie Theory 14:165-198, 2004).

Wednesday, 23rd

Topological properties of (tall) monotone complexity one spaces

S. Sabatini
University of Cologne

In symplectic geometry it is often the case that compact symplectic manifolds with large group symmetries admit indeed a Kähler structure. For instance, if the manifold is of dimension $2n$ and it is acted on effectively by a compact torus of dimension n in a Hamiltonian way (namely, there exists a moment map which describes the action), then it is well-known that there exists an invariant Kähler structure. These spaces are called symplectic toric manifolds or also complexity-zero spaces, where the complexity is given by n minus the dimension of the torus.

In this talk I will explain how there is some evidence that a similar statement holds true when the complexity is one and the manifold is monotone (the latter being the symplectic analog of the Fano condition in algebraic geometry), namely, that every monotone complexity-one space is simply connected and has Todd genus one, properties which are also enjoyed by Fano varieties. These results are largely inspired by the Fine-Panov conjecture and are in collaboration with Daniele Sepe [2].

Moreover, with Isabelle Charton and Daniele Sepe [1], we completely classify monotone complexity one space that are "tall" (no reduced space is a point), and prove that the torus action extends to a full toric action, that each of these spaces admits a Kähler structure and that there are finitely many such spaces, up to a notion of equivalence that will be introduced in the talk.

References:

[1] I.Charton, S.Sabatini, D.Sepe, "Compact monotone tall complexity one T-spaces", preprint.

[2] S.Sabatini, D.Sepe, "On topological properties of positive complexity one spaces", Transformation Groups 9 (2020).

Moment polytopes in real symplectic geometry

P.-E. Paradan
University of Montpellier

The aim of this talk is to explain how to parameterize the equations of the moment polytope associated with the action of a compact Lie group on a Kähler manifold: we adapt the techniques developed by Nicolas Ressayre for polarized algebraic varieties. We will show how to apply this tool to the case where the group and the manifold are provided with an involution. This "involution" framework will be illustrated using the convex cones naturally associated with isotropic representations of symmetric spaces.

Multiplicity-free $U(2)$-manifolds

N. Wardenski
Philipps-Universität Marburg

In this talk, we classify a certain subclass of compact, connected and multiplicity free Hamiltonian U(2)-manifolds with trivial principal isotropy group by giving explicit descriptions of their equivariant diffeomorphism type as well as their symplectic forms. Next, we link the existence of U(2)-invariant Kähler structures of multiplicity free U(2)-manifolds to the existence of T-invariant Kähler structures and the shape of their invariant momentum polytopes, where T is a maximal torus of U(2). This is joint work with Oliver Goertsches and Bart Van Steirteghem.

Thursday, 24th

The Gauss-Bonnet formula on polyhedral manifolds

S. Moroianu
IMAR Bucharest

The Gauss-Bonnet formula computes the Euler characteristic of a compact Riemannian manifold in terms of the Pfaffian polynomial applied to the curvature tensor. When the manifold has a boundary, or more generally corners, there appear additional terms involving the intrinsic curvature of the faces of every codimension, their second fundamental form, and the exterior angle fibrations. I will present results about the Gauss-Bonnet formula on certain compact singular spaces including polyhedral Riemannian manifolds and conical manifolds. Partly based on joint work with Daniel Cibotaru.

Double disk bundles

M. Kerin
Durham University

When searching for examples satisfying certain geometric properties, it is often convenient to examine manifolds constructed by gluing simple pieces together. One common example of such a construction involves gluing disk bundles together along their common boundary. On the other hand, many geometric phenomena impose strong topological conditions on the underlying manifold, such as the existence of a decomposition into a union of disk bundles (glued along a common boundary).

Given that they arise frequently from these two different viewpoints, it thus makes sense to study manifolds which decompose as a union of disk bundles in their own right. In this talk, I will report on joint work with J. DeVito and F. Galaz-García in this direction.

The Geometry of Aloff-Wallach Spaces

J. Henkel and H. Naujoks
Philipps-Universität Marburg

The focus of our attention will be on the Aloff-Wallach manifolds $\mathrm{SU}(3)/S^1_{k,l}$. The family of manifolds depending on the embedding parameters k, l is each equipped with a metric depending on four additional parameters. These six parameters in total lead to several interesting structures (Sasakian structures, 3-(α, δ)-Sasakian structures, Einstein metrics, nearly parallel G_2, positive curvature, etc.) on this set of Riemannian manifolds. The interplay of these structures is discussed.

Furthermore, we study the spectrum of the Laplace operator: The metrics on the Aloff-Wallach manifolds $\mathrm{SU}(3)/S^1_{k,l}$ are not normal homogeneous if they are not obtained by the rescaled Killing form. However, Wilking (1999) was able to prove that for $k = l = 1$ a family of positively curved Aloff-Wallach manifolds has normal homogeneous realizations. For the latter, we computed the spectrum of the Laplace operator explicitly using methods of representation theory. These results extend those of Urakawa (1984) who computed the spectrum in the $\mathrm{SU}(3)$-normal homogeneous case.

Geodesic completeness of pseudo-Riemannian Lie groups

Ana C. Ferreira
University of Minho

We will present recent developments in the classification of Lie groups with all their left-invariant pseudo-Riemannian metrics complete. More concretely, we will discuss the specifics of geodesic completeness when the manifold in question is a Lie group and recall the seminal work of Marsden for the compact (homogeneous) case. We will see how an interpretation in Riemannian terms of his techniques provided us with tools for characterising completeness even for general manifolds. As for Lie groups, we will show how a certain notion of "(sub)linear growth" allowed us to establish large classes of Lie groups whose left-invariant metrics are all complete.

Special Spinors on Homogeneous Spaces

J. Hofmann
King's College London

Special spinors play a key role in differential geometry, with beautiful (and often surprising) connections to many areas within the subject. The most famous examples are Riemannian Killing spinors, which are by now well understood to occur only in certain very special situations, and whose existence imposes strong geometric constraints on the underlying manifold. Various generalizations have been studied over the past several decades, but the problem of reliably producing examples of globally defined spinor fields in dimension >8 remains difficult. In this talk we explain how we have approached this question for various classes of homogeneous spaces, and how our obtained spinors encode the essential geometric features of the spaces. Based on joint work with I. Agricola, D. Artacho, and M-.A. Lawn.

Special Riemannian and Weyl holonomy

F. Belgun
IMAR Bukarest

N/A

Friday, 25th

Minimal Projective Orbits of Semi-simple Lie Groups

H. Winther
UiT The Arctic University of Norway

Let G be a Lie group with representation ρ on a real simple G-module $\mathbb{V}$. We will call the orbits of the induced action of ρ on the projectivization $P\mathbb{V}$ the projective orbits, and projective orbits of lowest possible dimension will be called minimal. We show that when G is semi-simple and non-compact, there exists a compact subgroup $K \subset G$ such that the minimal orbits of G are in bijection with the minimal K-orbits on a K-invariant proper subspace $\mathbb{W} \subset \mathbb{V}$. In the case that G is split-real, K is the trivial subgroup and there is a unique closed projective orbit, which is also the unique minimal orbit.

Canonical Submersions in Nearly Kähler Geometry

L. Stecker
University of Hamburg

We investigate Riemannian submersions introduced by reducible holonomy representations of connections with skew torsion. After giving the general theorem I will provide an overview to its currently understood applications, including $3-(\alpha,\delta)$-Sasaki, quaternionic Kähler and nearly Kähler manifolds. We then discuss in more detail how to obtain the nearly K¨ahler structures on twistor spaces from parallel $3-(\alpha,\delta)$-Sasaki manifolds through canonical submersions.

The kernel of the Gysin homomorphism on Chow groups of zero cycles

Claudia Schoemann
University of French Polynesia

Let S be a smooth projective surface over $\mathbb{C}$, and let C be a smooth hyperplane section of S. Let $\mathrm{CH}_0(S)_{\deg=0}$ and $\mathrm{CH}_0(C)_{\deg=0}$ be the Chow groups of zero cycles of degree 0 of S and C, respectively. We prove that the kernel of the Gysin homomorphism from $\mathrm{CH}_0(C)_{\deg=0}$ to $\mathrm{CH}_0(S)_{\deg=0}$ induced by the closed embedding of C into S is the countable union of shifts of a certain abelian subvariety A inside $J(C)$, the Jacobian of the curve C. Further we prove that either $A=0$ or A coincides with the abelian subvariety B in $J(C)$ corresponding to the vanishing cohomology $H^1(C,\mathbb{Q})_{\mathrm{van}}$. A major tool of proof is the irreducibility of the monodromy representation of the fundamental group of S on the vanishing cohomology of the curve C under the Gysin homomorphism using Lefschetz pencils.

We study the connection with Bloch's conjecture and constant cycle curves. We give some facts in positive characteristic.

This is joint work with Rina Paucar Rojas (IMCA, Peru).

G_2 structures on nilmanifolds and their moduli spaces

G. Bazzoni
Università degli Studi dell'Insubria

In this talk I will review non-integrable G_2 structures on 7-dimensional nilmanifolds. I will dwell on purely coclosed G_2 structures, constructing them from certain SU(3) structures in dimension 6. Also, I will illustrate some results on moduli spaces of (co)closed G_2 structures on nilmanifolds. This is based on joint work with A. Garvín, A. Gil García and V. Muñoz.

List of Participants

Ilka Agricola	Philipps-Universität Marburg
Giovanni Bazzoni	Università degli Studi dell'Insubria
Benjamin Becker	Philipps-Universität Marburg
Florin Belgun	IMAR Bukarest
Dario Di Pinto	Università degli Studi di Bari Aldo Moro
Giulia Dileo	Università degli Studi di Bari Aldo Moro
Ana Cristina Ferreira	University of Minho
Oliver Goertsches	Philipps-Universität Marburg
Nadine Große	University of Freiburg
Felippe Guimarães	KU Leuven
Jonas Henkel	Philipps-Universität Marburg
Jordan Hofmann	King's College London
Louis Ioos	CY Cergy University
Nicolina Istrati	Philipps-Universität Marburg
Max Jahnke	Philipps-Universität Marburg
Mustafa Kalafat	Bonn University
Martin Kerin	Durham University
Elias Knack	Philipps Universität Marburg
Panagiotis Konstantis	Philipps-Universität Marburg
Margarita Kraus	Johannes Gutenberg-Universität Mainz
Nicholas Lindsay	Universität zu Köln
Remi Lodh	Springer-Verlag Heidelberg
Eugenia Loiudice	Philipps-Universität Marburg
Xiaonan Ma	Université Paris Cité
Andrei Moroianu	Université Paris-Saclay
Sergiu Moroianu	IMAR Bucharest
Henrik Naujoks	Philipps-Universität Marburg
Rina Roxana Paugar Rojas	Universidad Nacional De Ingeneria
Paul-Emile Paradan	University of Montpellier
Leonid Polterovich	Tel Aviv University
Pablo Ramacher	Philipps-Universität Marburg
Thomas Rot	Vrij Universiteit Amsterdam

Silvia Sabatini	University of Cologne
Claudia Schoemann	University of French Polynesia
Leander Stecker	Universität Hamburg
Nikolas Wardenski	Philipps-Universität Marburg
Henrik Winther	UiT The Arctic University of Norway
Leopold Zoller	Ludwig-Maximilians-Universität München

Usefull Information

ATM Machines

Sparkasse Marburg-Biedenkopf
Potsdamer Str. 12

Pharmacy

Schloss-Apotheke
Wittelsberger Str. 1

Small Market

Hofladen Duske
open Tuesdays and Fridays from 4pm until 6:30 pm and upon appointment
Potsdamer Str. 7,
www.biolandhof-duske.de

Supermarket

Edeka-Markt
Große Gasse 2

Cabs

Taxi Brunett (06421/880099),
Taxy-Sorany (06421/484444),
Telecar Marburg (06421/25100) (usually cheaper).

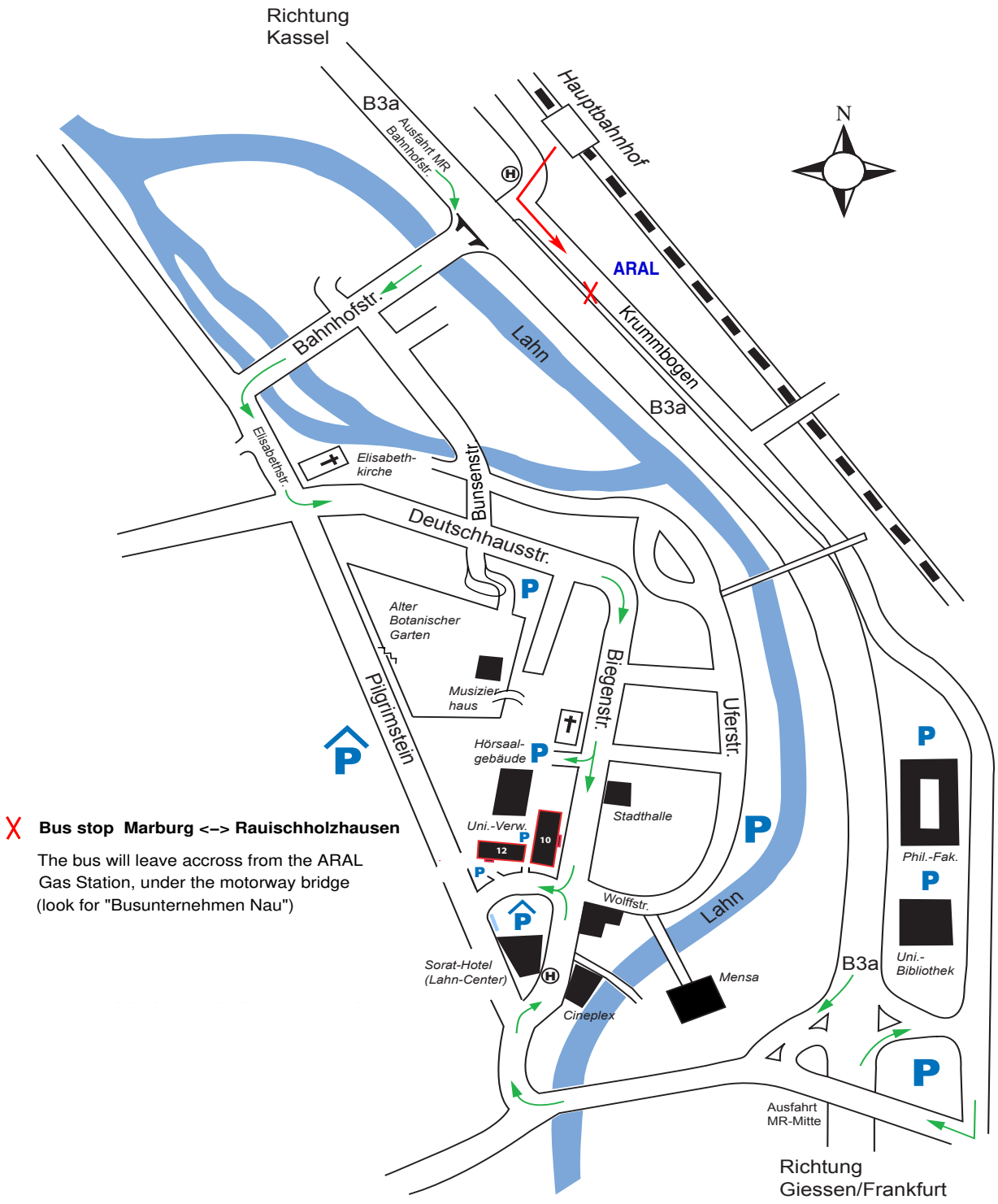
Castle Address

Schloss Rauischholzhausen,
Ferdinand-von-Stumm-Str.
35085 Ebsdorfergrund / Rauischholzhausen
Phone: +49 (0) 6424/301-100

Local Maps

Rauischholzhausen

Downtown Marburg



Bus stop Marburg <–> Rauischholzhausen

The bus will leave accross from the ARAL Gas Station, under the motorway bridge (look for "Busunternehmen Nau")