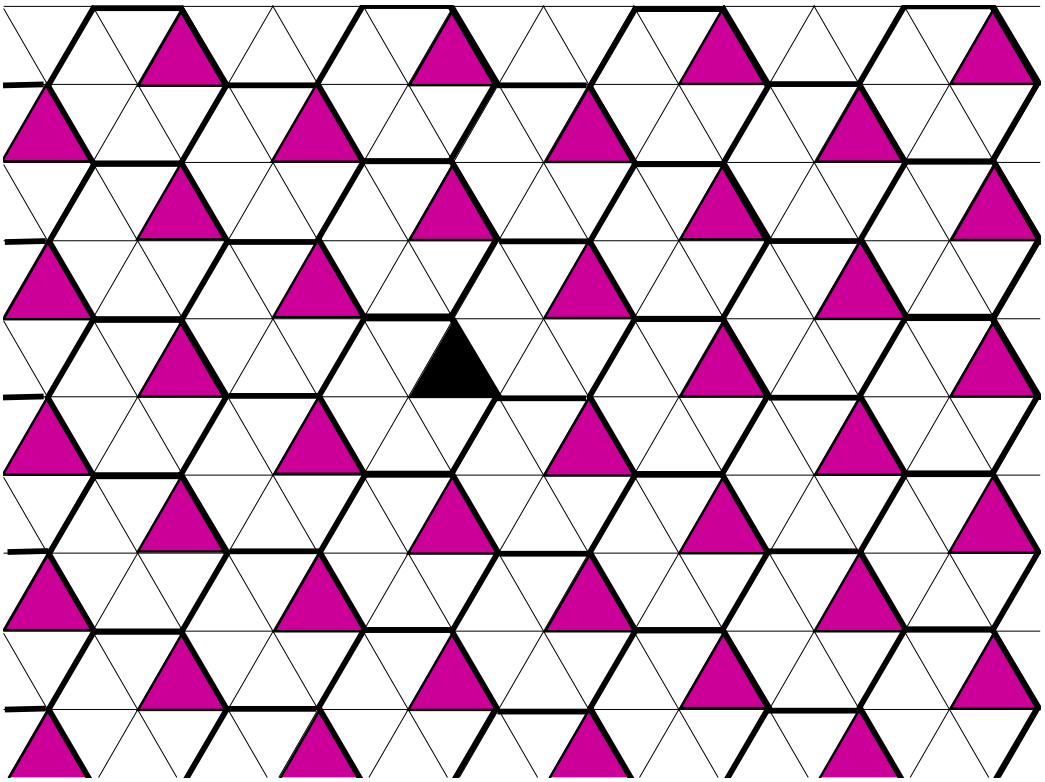
Buildings 2019

Conference booklet



Magdeburg, Germany

30^{th} of September to 2^{nd} of October 2019

Contents

Schedule

	Mo, 30.09		Tue, 01.10		Wed, 02.10
09:00	Registration and coffee	09:00	Ralf Köhl	09:00	Eduard Schesler
		10:00	Anneleen De Schepper	10:00	Rupert McCallum
10:30	Hendrik Van Maldeghem	10:30	Coffee break	10:30	Coffee break
11:30	Johannes Roth	11:00	Katharina Wendlandt	11:00	Jeroen Meulewaeter
12:10	Rainer Löwen	11:40	James Parkinson	11:40	Richard Weiss
12:40	Lunch	12:30	Lunch	12:30	Lunch
14:30	Yusra Naqvi	14:30	Magali Victoor		
15:30	Maike Gruchot	15:10	Christian Vock		
16:00	Coffee break	15:45	Coffee break		
16:30	Sebastian Bischof	16:15	Timothée Marquis		30 min talk
17:10	Luca Giuzzi				50 min talk

18:30 to 22:00	**Reception**

talks take place in room 02-311

coffee breaks in room 03-223

Some practical information

Talks will be held in Room **G02-311** (third floor of Gebäude 02) at the Otto von Guericke University Magdeburg. Coffee breaks shall take place in the Meeting Room of the Institute of Algebra and Geometry, **G03-223**. Though supposedly two buildings, the Gebäude 02 and 03 are interconnected – you don't have to leave the building when moving from the conference room to the coffee room.

Each participant will be given a coffee mug which they can use for coffee breaks (and then take home!). We kindly ask you to wash (if you so desire) your own mugs. There are some spots in Gebäuden 02 & 03 where you can do this (e.g. a sink located between the toilettes opposite to G03-210.)

The Meeting Room **G03-223** will furthermore be available for the participants throughout the conference. Blackboard and chalk are available.

The Reception will take place in the Common Room of the Faculty of Mathematics, **G02-210**.

The next page contains a simple map of the surroundings, indicating the building where the conference takes place (Gebäude 02 / 03 of the University) and some places where you can go grab a bite. These are the main spots:

- Gebäude 02 / 03: Faculty of Mathematics (right part of the *page*, i.e. upper marking on the *map*)
- Mensa & coffee (bottom part of the *page*, rightmost part of the map)
- Multiple restaraunts on the Erzbergerstraße, near the Universitätsplatz (bottom left corner of the *map*)

The map is also available at the conference webpage, where you can properly zoom in/out and also check out other places nearby the campus and the city center:

`https://www.geometry.ovgu.de/buildings.html`

Any changes or announcements will show up at the conference homepage or be announced between the talks.

Gebäude 02 / 03: Faculty of Mathematics
Döner/kebap place
Drinks
Subway
Japanese
Italian
Syrian
East Asian fast food
Soups and stew
Vietnamese
Bakery
East Asian
Greek
Döner/kebap place
Coffee and sweets
Mensa (main cafeteria of the university)
Coffee at the library
Universitätsbibliothek
Patentinformationszentrum
URZ
Universitätsviertel
Vilfredo-Pareto-Gebäude (G22)
Ada-Lovelace-Gebäude
Hohepfortewall
Festung Mark
Deutsche Telekom AG
Opernhaus
Berufsbildende Schulen "Otto von Guericke" Magdeburg
Walther-Rathenau-Straße
Universitätsplatz
Gareisstraße
Denhardtstraße
Falkenbergstraße
Richard-Wagner-Straße
Haydnplatz
Hohenstaufenring
Pfälzer Straße
Pfälzer Platz
Hohepfortestraße
Gustav-Adolf-Straße
Listemannstraße
Weitlingstraße
Breiter Weg
Erzbergerstraße
Am Krökentor
Jugendmigrationsdienst
Cafeteria
Unitheke

Abstracts

Sebastian Bischof
On commutator relations in RGD systems

In this talk I will show that the commutator of root groups corresponding to nested roots is trivial in a certain class of RGD systems.

Anneleen De Schepper
The magic box

Recent results of several authors hint at an expansion of the Freudenthal–Tits magic square, with new rows/columns corresponding to the so-called ternions and sextonions: 3- and 6-dimensional algebras over $\mathbb{K}$, respectively, very much behaving like the composition algebras used to construct the square, except that they are degenerate.

I will present a class of "degenerate composition algebras" which put these two cases in a general framework, and for the entire second row of the magic square (both the non-split and the split version), I will briefly give a geometric description and axiomatic characterisation of the corresponding varieties, together with their relations to both the non-degenerate versions and to affine buildings.

Luca Giuzzi
Generating and embedding polar Grassmannians

In this talk we shall present some recent results on the generating rank of classical polar spaces and their polar Grassmannians and the dimension of the Grassmann embedding.

Maike Gruchot
Complete reducibility: a buildings' point of view

By results of Serre and Bate–Martin–Röhrle, the usual notion of $\mathbf{G}$-complete reducibility can be re-framed as a property of an action of a group on the spherical building of the identity component of $\mathbf{G}$, where $\mathbf{G}$ is a reductive algebraic group.

In this talk, I will introduce a variation of this notion, the so-called relative complete reducibility. I will discuss that relative complete reducibility can also be viewed as a special case of the building-theoretic definition. This is a joint work with Alastair Litterick and Gerhard Röhrle.

Ralf Köhl
Generalized spin representations

A classical result states that the real Lie algebra $\mathfrak{so}(n)$ admits a presentation via the embedded $\mathfrak{so}(3)$-subalgebras along an A_{n-1} diagram, similar to the Curtis–Tits theorem and Phan's theorems.

String theorists are interested in studying the corresponding (infinite-dimensional) real Lie algebra $\mathfrak{k}$ for the diagram E_{10}. In my talk I will discuss a natural generalization of the classical 1/2-spin representation of $\mathfrak{so}(n)$ to this Lie algebra $\mathfrak{k}$. I will exhibit a Cartan–Bott-type periodicity for the images of this representation along the E_n series, and I will present a general machinery how to extend this 1/2-spin representation to higher spin representations. It will turn out that all these extended higher spin representations are controlled by a concise Weyl-group-based formula.

The results presented in this talk are based on prior work of Damour, Kleinschmidt, Nicolai and have been obtained jointly with Hainke, Horn, Lautenbacher, Levy in various combinations. The long-term goal is to develop a representation theory of $\mathfrak{k}$ and to understand the structure of $\mathfrak{k}$, for instance, whether $\mathfrak{k}$ is residually finite-dimensional.

Rainer Löwen
Regular parallelisms on $\mathrm{PG}(3,\mathbb{R})$ *admitting a* 2*-torus action*

We show that the parallelisms described by the title are precisely the 3-dimensional regular parallelisms in the sense of Betten and Riesinger. We point out that there is a problem with the existence proof given by those authors.

Timothée Marquis
Cyclically reduced elements in Coxeter groups

Let W be a Coxeter group. We provide a precise description of the conjugacy classes in W, yielding an analogue of Matsumoto's theorem for the conjugacy problem in arbitrary Coxeter groups.

Rupert McCallum
Ihara zeta functions for "building lattices"

Ihara introduced a zeta function for co-compact discrete torsion-free subgroups of $\mathrm{PGL}_2(\mathbb{F})$ for a non-archimedean local field $\mathbb{F}$ and Serre showed how to view the Ihara zeta function as an object which can be attached to an arbitrary finite graph. In recent work with Anton Deitmar and Minghsuan Kang we have been exploring possible ways to generalise the Ihara zeta function to the non-compact case and to higher dimensions. We present some of the possible approaches to doing this and prove a conjecture of Anton Deitmar about the rationality of the higher-dimensional Ihara zeta function so defined, and also a conjecture made in previous work with Minghsuan Kang about the connection of one such zeta function with an alternating product of Poincaré series.

Jeroen Meulewaeter
Inner line ideal geometries

Extremal geometries are point-line geometries introduced by Arjeh Cohen and collaborators, where points are the extremal elements of specific simple Lie algebras and the lines are some two-dimensional subspaces. However, polar spaces cannot be obtained as extremal geometries.

Together with Hans Cuypers, we describe the so-called inner line ideal geometry. Its points are still the extremal elements, but we give a more general definition of lines using inner ideals. This allows us to obtain both the extremal geometries and polar spaces.

Yusra Naqvi
Retractions from infinity

Positively folded galleries arise as images of retractions of buildings onto a fixed apartment and play a role in many areas of maths, such as in the study of affine Hecke algebras, Macdonald polynomials, MV-polytopes, and affine Deligne–Lusztig varieties. In this talk, we will see a new recursive description of the set of end alcoves of folded galleries which are positive with respect to alcove-induced orientations. These results further allow us to find the images of retractions from certain points at infinity. This talk is based on joint work with Elizabeth Milićević, Petra Schwer and Anne Thomas.

James Parkinson
Patterns in sets of positive density in trees and buildings

We prove an analogue for homogeneous trees and affine buildings of a result of Bourgain on geometric Ramsay theory in Euclidean spaces. In particular, we show that certain configurations of vertices are guaranteed to exist in any set of positive upper density in a homogeneous tree or affine building. This is joint work with M. Björklund and A. Fish.

Johannes Roth
Constructing (mixed) metasymplectic spaces

A metasymplectic space is a geometry with four types of elements, usually called points, lines, planes and hyperlines. In this talk I will give a short overview on how to construct such a space using a Chevalley group of type F_4. The elements of the constructed geometry will be 'certain' subspaces of a 26-dimensional vector space. Mixing the group will then allow us to obtain a mixed metasymplectic space. Here, however, the hyperlines fail to be subspaces of said vector space.

Eduard Schesler
The Σ-conjecture for solvable S-arithmetic groups via Morse theory on Euclidean buildings

Given a finitely generated group G, the Σ-invariants of G consist of geometrically defined subsets $\Sigma^k(G)$ of the set $\mathbb{S}(G)$ of all characters $\chi : G \to \mathbb{R}$ of G. These invariants were introduced independently by Bieri–Strebel and Neumann for $k = 1$ and generalized by Bieri–Renz to the general case in the late 80's in order to determine the finiteness properties of all subgroups H of G that contain the commutator subgroup $[G, G]$.

In this talk we determine the Σ-invariants of certain S-arithmetic subgroups of Borel groups in Chevalley groups. In particular we will determine the finiteness properties of every subgroup H of the group of upper triangular matrices $\mathbf{B}_n(\mathbb{Z}[1/p]) < \mathrm{SL}_n(\mathbb{Z}[1/p])$ that contains the group $\mathbf{U}_n(\mathbb{Z}[1/p])$ of unipotent matrices, where p is any sufficiently large prime number.

Hendrik Van Maldeghem
$\mathrm{F}_4 < \mathrm{E}_7$

In this talk I will discuss several features of the occurrence of a building of type F_4 inside a building of type E_7.

Magali Victoor
Geometrical constructions of buildings in the magic square

In this talk I follow a geometric approach to the Freudenthal–Tits Magic Square. The geometries in this square are all buildings and parapolar spaces, and it is well known that they can be embedded in a projective space. This construction is however rather algebraic and not always easily accessible if you want to study these geometries with geometric methods. I give a very explicit construction of the geometries in the second and third row as the intersection of quadratic equations in a projective space. I also give a few examples of how I have already used this construction to study these geometries.

Christian Vock
The weakly complete group algebra of a topological group

We construct a group algebra for every topological group that contains a topology. This group algebra is associated functorially and we call it a weakly complete group algebra that is based on the category of weakly complete vector spaces. In the case that the group is compact, its weakly complete real group algebra contains the group as a pro-Lie group and it contains also a copy of its Lie algebra.

Richard Weiss
Exceptional Tits quadrangles

We will describe efforts to classify Tits quadrangles. The focus of our work has been the Tits quadrangles that arise from exceptional groups. We will discuss applications of our results to the study of exceptional groups of relative rank 1. This is joint work with Bernhard Mühlherr.

Katharina Wendlandt
Twin buildings of type $\tilde{C}_2$

We describe the classification of all $\tilde{C}_2$-twin buildings having one residue of exceptional type.

List of participants

Barbara Baumeister (*Universität Bielefeld*)
Lara Beßmann (*Westfälische Wilhelms-Universität Münster*)
Sebastian Bischof (*Justus-Liebig-Universität Gießen*)
Tobias Boege (*Otto-von-Guericke-Universität Magdeburg*)
Jens Bossaert (*Universiteit Gent*)
Anneleen De Schepper (*Universiteit Gent*)
Luca Giuzzi (*Università degli Studi di Brescia*)
Zohar Grinbaum-Reizis (*Oniversitat Ben-Guriyon baNegev*)
Maike Gruchot (*Rheinisch-Westfälische Technische Hochschule Aachen*)
Julius Grüning (*Justus-Liebig-Universität Gießen*)
Matthias Grüninger (*Justus-Liebig-Universität Gießen*)
Paula Harring (*Justus-Liebig-Universität Gießen*)
Paulien Jansen (*Universiteit Gent & Université Libre de Bruxelles*)
Thomas Kahle (*Otto-von-Guericke-Universität Magdeburg*)
Ralf Köhl (*Justus-Liebig-Universität Gießen*)
Linus Kramer (*Westfälische Wilhelms-Universität Münster*)
Nils Leder (*Westfälische Wilhelms-Universität Münster*)
Marco Lotz (*Otto-von-Guericke-Universität Magdeburg*)
Rainer Löwen (*Technische Universität Braunschweig*)
Timothée Marquis (*Université catholique de Louvain*)
Andreas Mars (*Technische Universität Darmstadt*)
Rupert McCallum
Jeroen Meulewaeter (*Universiteit Gent*)
Philip Möller (*Westfälische Wilhelms-Universität Münster*)
Bernhard Mühlherr (*Justus-Liebig-Universität Gießen*)
Yusra Naqvi (*University of Sydney*)
Georges Neaime (*Universität Bielefeld*)
James Parkinson (*University of Sydney*)
Maximilian Parr (*Justus-Liebig-Universität Gießen*)
Antonio Pasini (emeritus, *Università degli Studi di Siena*)
Johannes Roth (*Universiteit Gent*)

Yuri Santos Rego (*Otto-von-Guericke-Universität Magdeburg*)
Eduard Schesler (*Universität Bielefeld*)
Petra Schwer (*Otto-von-Guericke-Universität Magdeburg*)
François Thilmany (*University of California, San Diego*)
Thomas Titz Mite (*Justus-Liebig-Universität Gießen*)
Hendrik Van Maldeghem (*Universiteit Gent*)
Olga Varghese (*Westfälische Wilhelms-Universität Münster*)
Magali Victoor (*Universiteit Gent*)
Christian Vock (*Technische Universität Darmstadt & Justus-Liebig-Universität Gießen*)
Richard Weiss (*Tufts University*)
Katharina Wendlandt (*Justus-Liebig-Universität Gießen*)
David Weniger (*Duale Hochschule Baden-Württemberg Mosbach*)
Torben Wiedemann (*Justus-Liebig-Universität Gießen*)
Lisa Wipper (*Justus-Liebig-Universität Gießen*)
Stefan Witzel (*Universität Bielefeld*)

Organizing commitee:

Yuri Santos Rego
Petra Schwer

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