

LIE THEORY AND GEOMETRY

CASTLE RAUSCHHOLZHAUSEN, MARCH 8 – 11, 2016



supported by
SPP 1388 "Representation Theory" of the DFG

Lie Theory and Geometry

Castle Rauschholzhausen, March 8 – 11, 2016

Tuesday, March 8

- 12:30 lunch
- 14:00–14:50 Gerhard Röhrle (Bochum)
Cocharacter closure and spherical buildings
– coffee break –
- 15:30–16:10 Thimothée Marquis
Positive energy representations of Hilbert loop algebras
- 16:20–16:50 Marina Statha
Invariant Einstein metrics on Stiefel manifolds
- 17:00–17:30 Sam Noshari
Equivariant formality of isotropy actions on homogeneous spaces
- 19:00 dinner

Wednesday, March 9

- 09:00–09:50 Alex Küronya
Szyzgies on abelian surfaces, construction of singular divisors,
and Newton-Okounkov bodies
– coffee break –
- 10:30–11:10 Yurii Nikonorov
The evolution of positively curved invariant metrics on Wallach
spaces under the Ricci flow
- 11:20–12:00 Francisco Palomo Ruiz
Lightlike manifolds and conformal geometry
– lunch break –
- 14:00–14:50 Ines Kath
Compact quotients of Cahen-Wallach spaces
- 15:00–15:30 Giovanni Bazzoni
Locally conformal symplectic structure on Lie groups
– coffee break –
- 16:00–16:30 Andreas Krug
Hilbert schemes, symmetric quotient stacks, and categorical
Heisenberg actions
- 16:40–17:10 Markus Röser
Hyperkähler implosion and Nahm's equation
- 17:20–17:50 Simon Lentner
Restriction for arrangements, Weyl groupoids and Nichols algebras
- 19:00 dinner

Thursday, March 10

- 09:00–09:50 Stefan Müller-Stach
Arakelov Inequalities
– coffee break –
- 10:30–11:10 Yusuke Sakane
Einstein metrics on compact simple Lie groups
- 11:20–12:00 Andreas Kollross
Hyperpolar actions on reducible symmetric spaces
– lunch break –
- 14:00–14:50 Idrisse Khemar
Integrable systems in homogeneous geometry, Sigma model, Twistor space
- 15:00–15:30 Hassan Jolany
Logarithmic Weil-Petersson metrics on the moduli space of Log Calabi
Yau manifolds
– coffee break –
- 16:00–16:30 Aprameyan Parthasarathy
Restriction of discrete series representations to minimal parabolic subgroups
- 16:40–17:10 Ioannis Chrysikos
Spin structures on flag manifolds and C-spaces
- 17:20–17:50 Henrik Winther
Strictly nearly pseudo-Kähler manifolds with large symmetry groups
- 19:00 dinner

Friday, March 11

- 09:00–09:50 Anton Alekseev
The Horn problem and planar networks
– coffee break –
- 10:30–11:00 Joshua Groeger
Holonomy in Supergeometry: Theory and Applications
- 11:10–11:40 Florin Belgun
From Hill's equation to conformal geometry
– lunch break –
- 13:30–14:20 Ehud Meir
Hopf algebra invariants, symmetric monoidal categories and geometric
invariant theory
– coffee break –
- 14:50–15:30 Dmitri Alekseevsky
Classification of cohomogeneity one Kähler-Einstein G -manifolds with
one singular orbit
- 15:40–16:10 Lars Schäfer
On nearly pseudo-Kähler manifolds
- 16:45 bus leaving at the upper parking
- 18:00 dinner (for those staying until Saturday)

Abstracts (if available)

Alekseevsky, Dmitri – Classification of cohomogeneity one Kähler-Einstein G -manifolds with one singular orbit. Let G be a compact semisimple Lie group. We describe all cohomogeneity one G -manifolds M with one singular orbit G/H which admit invariant Kaehler metric g of standard type. The manifolds are described in terms of painted Dynkin diagrams and characters of H . The metric g is explicitly determined by a parametrized interval in some T -Weyl chamber. We describe when the manifold M admits an invariant Kähler-Einstein metric and write down the corresponding parametrized interval. In the case of non positive Einstein constant, the Kähler-Einstein metric is complete. The talk is based on a joint work with Fabio Zuddas.

Belgun, Florin – From Hill’s equation to conformal geometry. Any curve C in a conformal manifold inherits a projective structure, given by a Hill operator. The moduli space M of projective structures on a circle is a locally one-dimensional, non-Hausdorff space. Studying the map from the loop space of a conformal manifold to M , associating to a smooth loop its inherited projective structure, leads to global conformal invariants. We determine the image of this map for open subsets of Euclidean spaces, and for some of their (conformally flat) quotients.

Lentner, Simon – Restriction for arrangements, Weyl groupoids and Nichols algebras. Crystallographic hyperplane arrangements can be used as a generalization of root systems, where the Weyl group is replaced by a Weyl groupoid. They appear naturally as the Lie-theoretic structure that governs Nichols algebras resp. pointed Hopf algebras. I will talk about recent work with M. Cuntz, where we translate the restriction of arrangements into the Nichols algebra context. As one type of example, every Nichols algebra gives rise to a family of Nichols algebras with restricted root systems (that can be organized into a simplicial complex). In particular we can show that most Weyl groupoids do indeed appear for some Nichols algebra. A more involved type of examples are restrictions to fixpoint sets of involutions. As a special case this describes the root systems that have appeared in my folding construction of Nichols algebras over nonabelian groups. More general cases are strongly related to quantum symmetric pairs and to similar new examples. I will close with an outlook on recent further work in this direction.

Meir, Ehud – Hopf algebra invariants, symmetric monoidal categories and geometric invariant theory. In this talk I will describe an approach to study finite dimensional semisimple Hopf algebras by geometric invariant theory. I will explain why such Hopf algebras can be studied using invariant theory, and will describe a complete set of invariants for such Hopf algebras. I will then give an intuitive description of some of these invariants. One central application of this, using methods of symmetric monoidal categories, is a constructive description of the space of A -invariants in H , where A is the group of all Hopf automorphism of H . I will explain this description, and how it implies the finiteness of the number of Hopf orders of H . If time permits, I will explain how can one also study related structures (such as comodule algebras or fusion categories) using these methods.

Nikonorov, Yurii – The evolution of positively curved invariant metrics on Wallach spaces under the Ricci flow. We study the evolution of positively curved metrics on the Wallach spaces $SU(3)/T_{\max}$, $Sp(3)/Sp(1) \times Sp(1) \times Sp(1)$, and $F_4/Spin(8)$. We prove that for all Wallach spaces, the normalized Ricci flow evolves all generic invariant Riemannian metrics with positive sectional curvature into metrics with mixed sectional curvature. Moreover, we prove that for the spaces $Sp(3)/Sp(1) \times Sp(1) \times Sp(1)$ and $F_4/Spin(8)$, the normalized Ricci flow evolves all generic invariant Riemannian metrics with positive Ricci curvature into metrics with mixed Ricci curvature. We also obtained similar results for some more general homogeneous spaces. This talk is based on a recent joint paper with N.A. Abiev.

Palomo, Francisco J. – Lightlike manifolds and conformal Geometry. The study of lightlike manifolds in a Lorentzian manifold (or more generally in a pseudo-Riemannian manifold) has been a topic of growing interest in the development of Mathematics and Physics of Gravitation. The key difference between the lightlike manifolds and the cases of spacelike or timelike manifolds is due to the fact that a lightlike manifold inherits a degenerate tensor from the ambient metric. Therefore, the usual theory of nondegenerate submanifolds fails for lightlike manifolds. In order to avoid this difficulty, several techniques have been developed from the sixties. In this talk, we recall the notion of Cartan geometry on a manifold M with model a homogeneous space G/P and the construction of correspondence spaces for H a closed subgroup of P . For the particular case that G is the Möbius group and P is the Poincaré conformal group, every Cartan geometry with model G/P provides a conformal pseudo-Riemannian structure on the base manifold M . Finally, we show how certain lightlike manifolds can be seen as correspondence spaces of conformal structures for a certain closed subgroup $H \subset P$.

Parthasarathy, Aprameyan – Restriction of discrete series representations to minimal parabolic subgroups. In this talk, we'll describe some ideas concerning the restriction problem for (non-holomorphic) discrete series representations of a real reductive group G to a (minimal) parabolic subgroup P . As a first example in the non-Hermitian case, we'll discuss the case of $\text{Spin}(4,1)$ - an example that is interesting in itself, and also serves as a test case for our general strategy. Motivated by geometric considerations we show that only finitely many discrete series of P appear with non-zero multiplicity in the restriction, in contrast to the Hermitian case. Our work is related to certain conjectures of Duflo about the geometric nature of branching rules. This is joint work with Gang Liu (Uni. Metz, France).

Röser, Markus – Hyperkähler implosion and Nahm's equation. In 2001 Guillemin, Jeffrey and Sjamaar introduced symplectic implosion, an abelianisation procedure for Hamiltonian group actions which has interesting links with representation theory and (non-reductive) geometric invariant theory. From the point of view of the orbit method, it is related to the theorem of Cartan and Weyl that every representation of a compact connected Lie group is determined by its highest weight vector. In this talk we shall describe joint work with Andrew Dancer and Frances Kirwan, which attempts to find an analogue of this construction in hyperkähler geometry using gauge-theoretic methods. As a by-product we obtain a gauge-theoretic description of symplectic implosion.

Sakane, Yusuke – Einstein metrics on compact simple Lie groups. In 1979 D'Atri and Ziller started a study of homogeneous Einstein metrics on compact semisimple Lie groups. They gave a characterization of naturally reductive metrics among left-invariant metrics on a compact simple Lie group G and obtained many homogeneous Einstein metrics on the Lie group G . D'Atri and Ziller also asked whether G admits a non-naturally reductive Einstein metric. In this talk we describe how we can construct non-naturally reductive Einstein metrics on compact simple Lie groups.

The talk is based on joint work with Andreas Arvanitoyeorgos, Ioannis Chrysikos, Kunihiko Mori and Marina Statha.

Statha, Marina – Invariant Einstein metrics on Stiefel manifolds. The problem of finding invariant Einstein metrics on Stiefel manifolds has been originally studied by S. Kobayashi, A. Sagle, G. Jensen. Later, A. Arvanitoyeorgos, D.D. Dzhepko and Yu. G. Nikonorov obtained new invariant Einstein metrics on the Stiefel manifolds $V_{sk}\mathbb{F}^{sk+l} \cong G(sk+l)/G(l)$, where $\mathbb{F} \in \{\mathbb{R}, \mathbb{H}\}$ and $G(l) \in \{SO(l), Sp(l)\}$ respectively, by making some extra symmetry assumptions. The difficulty with Stiefel manifolds is that the isotropy representation contains equivalent summands,

hence the Ricci tensor for an invariant metric is not easy to describe. In the present work we prove existence of new invariant Einstein metrics on the Stiefel manifolds $V_4\mathbb{R}^n$ ($n \geq 6$), $V_5\mathbb{R}^7$ and $V_2\mathbb{H}^n$ ($n \geq 3$). Our method is based on considering real and quaternionic Stiefel manifolds as total spaces over generalized Wallach spaces, and also for the quaternionic case, as total space over flag manifolds with two isotropy summands. The Einstein metrics that we obtain belong in a special subset of all invariant metrics.

This presentation is based on joint work with A. Arvanitoyeorgos and Y. Sakane.

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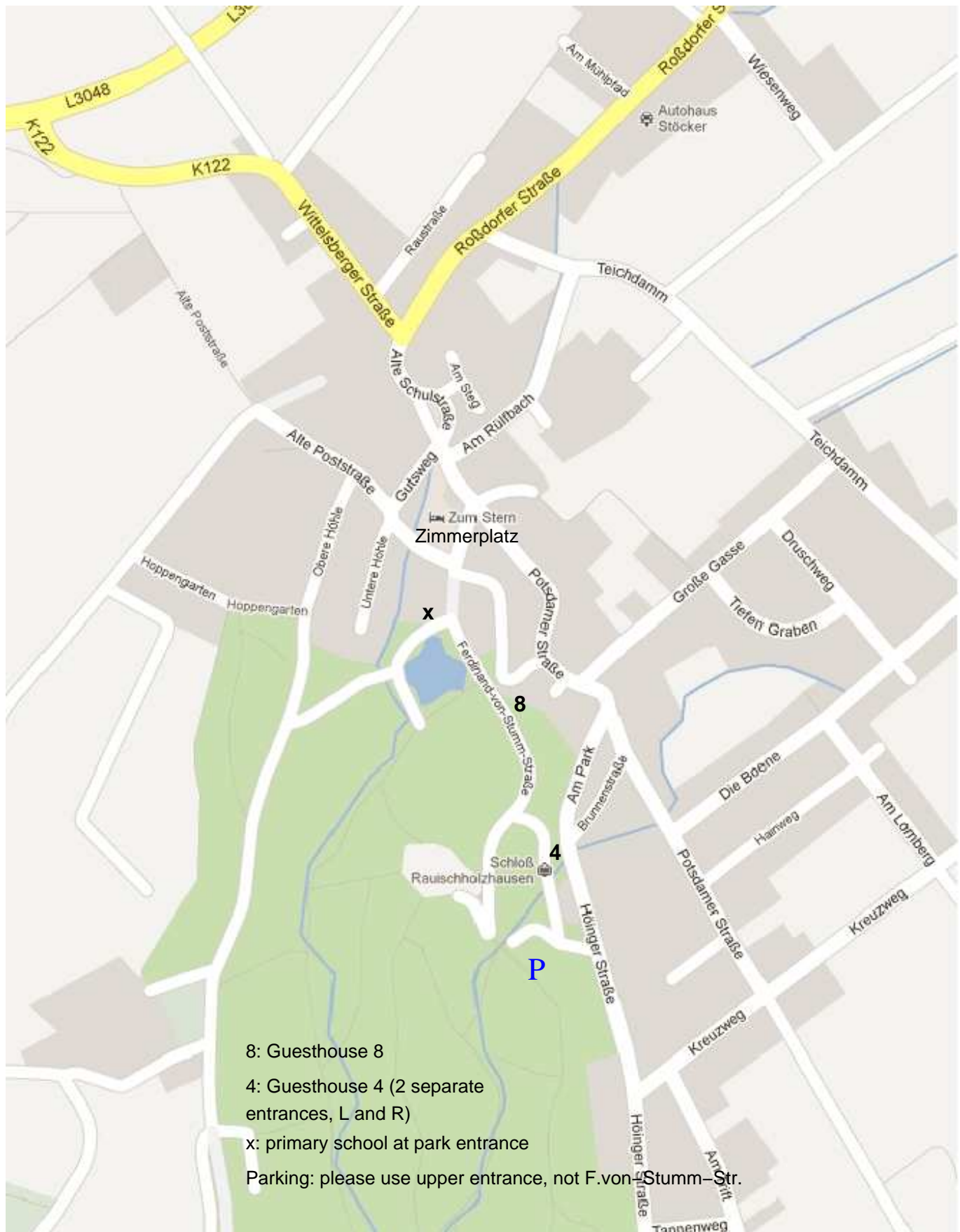
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Local map (Rauschholzhausen)



Useful addresses in Rauischholzhausen:

Sparkasse Marburg-Biedenkopf (bank with ATM machines)
Potsdamer Str. 12, 06424 / 928008

Schloss-Apotheke (pharmacy)
Wittelsberger Str. 1, 06424 / 3575

Hofladen Duske (farm market)
open Tue and Fr 4 pm – 6:30 pm and upon appointment
Potsdamer Str. 7, 06424 / 70207
www.biolandhof-duske.de

Edeka-Markt (supermarket)
Große Gasse 2

Taxis:

normal taxis: Taxi Brunett (06421 / 880099), Taxi-Sorany (06421 / 484444).
taxi with fixed price (usually cheaper): Telecar Marburg (06421 / 25100)

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Local map (downtown Marburg)

