



SSL 47

Seminar Sophus Lie

CASTLE RAUISCHHOLZHAUSEN
MAY 29-31, 2014

ORGANIZED BY ILKA AGRICOLA AND
ISTVÁN HECKENBERGER, MARBURG
AND BY RALF KÖHL, GIESSEN



<http://www.mathematik.uni-marburg.de/~agricola/rauisch2014>

Helmann 2014

47th Seminar Sophus Lie
Castle Rauschholzhausen, May 29-31, 2014

Organizers: Ilka Agricola (Universität Marburg)
Istvan Heckenberger (Universität Marburg)
Ralf Köhl (Universität Gießen)

sponsored by SPP 1388 'Representation Theory' of the DFG

Programme

Friday, May 30th

- 9:00-09:50 Anna Fino (Università degli Studi di Torino, Italy)
Solvable Lie groups and Hermitian geometry
– coffee break –
- 10:30-11:20 Ulrich Krähmer (University of Glasgow, UK)
On the Dolbeault-Dirac operator of a quantised Hermitian symmetric space
- 11:30-12:10 Alexander Alldridge (Universität Köln)
Fourier inversion and Paley-Wiener theorem for Riemannian symmetric superspaces of rank one
– lunch break –
- 14:00-14:40 Maurizio Parton (Università di Chieti – Pescara, Italy),
Spin(9), Rosenfeld planes and canonical differential forms in octonionic geometry
- 14:50-15:30 Max Horn (Justus-Liebig-Universität Gießen)
Generalized Spin representations
– coffee break –
- 16:10-16:50 Andreas Arvanitoyeorgos (University of Patras, Greece)
Homogeneous Einstein metrics on Stiefel manifolds and compact Lie groups
- 17:00-17:40 Boris Kruglikov (University of Tromsø, Norway)
Homogeneous almost complex and related structures in dimension 6

Saturday, May 31st

- 9:00-09:50 Vicente Cortes (Universität Hamburg)
Symplectic Lie groups
– coffee break –
- 10:30-11:20 Konrad Waldorf (Ernst-Moritz-Arndt-Universität Greifswald)
Loop group geometry and transgression
- 11:30-12:10 Aleksy Tralle (University of Warmia and Mazury in Olsztyn, Poland)
Almost compact Clifford-Klein forms
– lunch break –
- 14:00-14:40 Oliver Goertsches (Universität Hamburg)
Positively curved GKM-manifolds
- 14:50-15:30 Valdemar Tsanov (Ruhr-Universität Bochum)
Cohomological components of modules
– coffee break –
- 16:00-16:40 Cristian Lenart (MPI Bonn)
Specialized Macdonald polynomials, quantum K-theory, and Kirillov-Reshetikhin modules
- 17:00 bus departure

Abstracts

Alldrige, Alexander – Fourier inversion and Paley-Wiener theorem for Riemannian symmetric superspaces of rank one. We report on recent progress in the harmonic analysis on Riemannian symmetric superspaces of rank one. Contrary to the non-super situation, there are discrete parts of the spectrum, which leads to interesting predictions in the condensed matter physics. This is joint work with my recent PhD student Wolfgang Palzer.

Arvanitoyeorgos, Andreas – Homogeneous Einstein metrics on Stiefel manifolds and compact Lie groups. We study Einstein metrics on homogeneous spaces whose isotropy representation contains equivalent summands. The description of invariant metrics on such spaces is not easy in general. By making some symmetry assumption we obtain some new invariant Einstein metrics on certain Stiefel manifolds $SO(n)/SO(n-k)$ of orthonormal k -frames in \mathbb{R}^n , not previously obtained by Sagle, Jensen, and Arvanitoyeorgos-Dzhepkov-Nikonov. We also apply such method to obtain left-invariant Einstein metrics on the compact Lie group $SO(n)$ which are not naturally reductive.

Goertsches, Oliver – Positively curved GKM-manifolds. A fruitful approach to the positive sectional curvature assumption in Riemannian geometry is to assume some kind of symmetry. While often the existence of an effective action of a torus is required whose dimension grows with the dimension of the manifold we consider here positively curved manifolds with a different symmetry assumption, namely the existence of a torus action of GKM-type: these actions have only finitely many fixed points and their one-skeleton, i.e., the union of the one-dimensional orbits, is two-dimensional. We observe that all known examples of even-dimensional positively curved manifolds admit a GKM action. The relevance of this notion comes from the fact that for these actions the equivariant cohomology algebra can be computed explicitly from a graph which encodes the structure of the one-skeleton. This information can then be used to compute the ordinary de Rham cohomology of the manifold. The main result to be presented is that under a slightly more restrictive assumption on the strata of the action, we can determine the structure of the one-skeleton, and consequently the de Rham cohomology completely: a positively curved GKM_3 -manifold has the real cohomology ring of a compact rank one symmetric space. (Based on joint work with Michael Wiemeler)

Krähmer, Ulrich – On the Dolbeault-Dirac operator of a quantised Hermitian symmetric space. In this joint work with Matthew Tucker-Simmons (U Berkeley) the Dolbeault complex of the quantised compact Hermitian symmetric spaces is identified with the Koszul complexes of the quantised symmetric algebras of Berenstein and Zwicknagl. This leads for example to an explicit construction of the relevant quantised Clifford algebras.

Kruglikov, Boris – Homogeneous almost complex and related structures in dimension 6. We give a classification of invariant almost complex and related (almost Hermitian, almost symplectic) structures on homogeneous manifolds of dimension 6 with semi-simple isotropy, and describe their integrability and other geometric properties. Those structures with non-degenerate Nijenhuis tensor are shown to have the automorphism group of dimension either 14 or 9. We also discuss the maximal and submaximal dimensions (gap) problem for these structures (joint work with Dmitri Alekseevsky and Henrik Winther).

Lenart, Cristian – Specialized Macdonald polynomials, quantum K-theory, and Kirillov-Reshetikhin modules. The Macdonald polynomials are Weyl group invariant polynomials with rational function coefficients (in q, t), which specialize to the irreducible Lie algebra characters upon setting $q = t = 0$. Quantum K-theory is a K-theoretic generalization of quantum cohomology. Kirillov-Reshetikhin (KR) modules are certain finite-dimensional modules for affine Lie algebras. Braverman and Finkelberg related the Macdonald polynomials specialized at $t = 0$ to the quantum K-theory of flag varieties. With S. Naito, D. Sagaki, A. Schilling, and M. Shimozono,

we proved that the same specialization of Macdonald polynomials equals the graded character of a tensor product of (one-column) KR modules. I will discuss the combinatorics underlying these connections.

Parton, Maurizio – Spin(9), Rosenfeld planes and canonical differential forms in octonionic geometry. Starting from the description of Spin(9) as generated by 9 involutions in $SO(16)$, I will construct canonical differential forms associated with structures in higher dimensions given by the groups $Spin(10)U(1)$, $Spin(12)Sp(1)$ and $Spin(16)$ in dimensions 32, 64 and 128 respectively. The motivation is given by the holonomies of the Rosenfeld projective planes EIII, EVI and EVIII, where the described differential forms appear as generators of their cohomologies. The construction here given appears as extending that of the quaternionic 4-form associated with $Sp(2)Sp(1)$, of the Spin(7) form in dimension 8 and of the 8-form associated with Spin(9) in dimension 16. All these differential forms appear to be nested one into the other, giving rise to a "matryoshka" of canonical differential forms associated with different groups of octonionic geometry. This is a joint work with Paolo Piccinni.

Tralle, Aleksy – Compact Clifford-Klein forms. My talk will be devoted to the problem of finding compact Clifford-Klein forms. We find a method of constructing almost complex Clifford-Klein forms in terms of Satake diagrams. In particular, we give new examples of such forms.

Tsanov, Valdemar – Cohomological components of modules. Let $G \rightarrow G'$ be an embedding of semisimple complex Lie groups, let B and B' be a pair of nested Borel subgroups, and let $f : G/B \rightarrow G'/B'$ be the associated equivariant embedding of flag manifolds. We study the pullbacks of cohomologies of invertible sheaves on G'/B' along the embedding f . Let O' be a G' -equivariant invertible sheaf on G'/B' , and let O be its restriction to G/B . Consider the G -equivariant pullback on cohomology $p : H(G'/B', O') \rightarrow H(G/B, O)$. The Borel-Weil-Bott theorem implies that the two cohomology spaces above are irreducible modules of G' and G respectively. By Schur's lemma, p is either surjective or zero. We establish a necessary and sufficient condition for nonvanishing of p , and prove a structure theorem about the set of cohomological pairs of highest weights. We also study in detail some special cases of embeddings, e.g. regular and diagonal. The methods rely on Kostant's theory of Lie algebra cohomology.

Waldorf, Konrad – Loop group geometry and transgression. Transgression takes gerbes over a manifold M and produces circle bundles over the free loop space LM . This is particularly interesting when M is a compact Lie group G , since these Lie groups come equipped with canonical gerbes, whose associated circle bundles over LG are in fact central extensions. I will explain a bit the basics of transgression and point out some implications for loop group extensions. As an application I will talk about the spin geometry of loop spaces and how insights from transgression can be used there.

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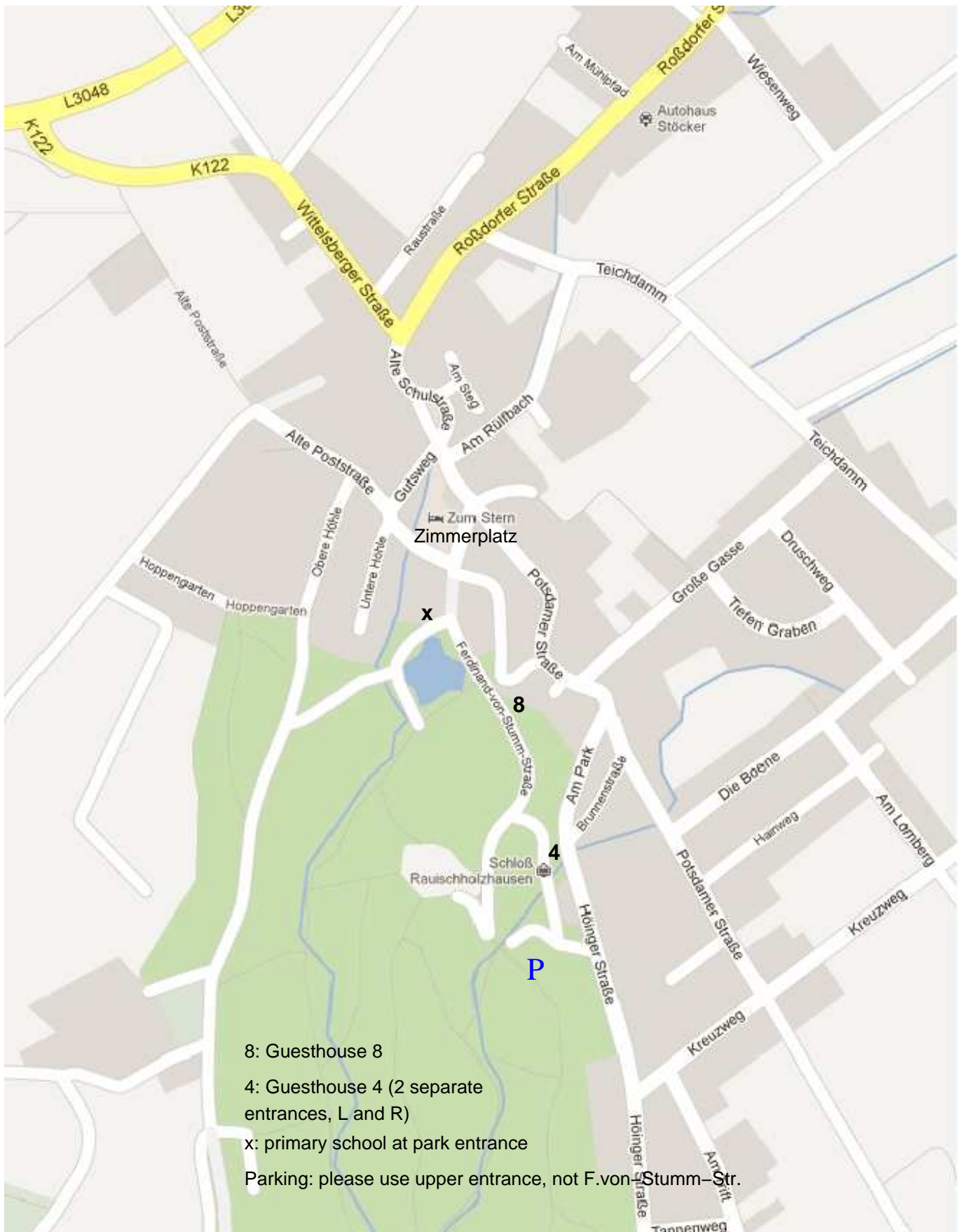
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Local map (Rauischholzhausen)



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): City Taxi Marburg (06421 / 5 11 11).

Because of past bad experiences, we cannot recommend Telecar Marburg anymore.

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Local map (downtown Marburg)

