51st Seminar Sophus Lie, Göttingen, June 30-July 1, 2017

Abstracts:

J.-Ph. Anker (Université d'Orléans): The Schrödinger equation for the fractional Laplacian on hyperbolic spaces

In joint work with Y. Sire, we study the Schrödinger equation associated with fractional powers of the Laplace-Beltrami operator on symmetric spaces. In this talk, we will mostly consider dispersive and Strichartz inequalities on hyperbolic spaces, which behave much better than in the Euclidean setting.

G. Heckman (Radboud University Nijmegen): Real hyperbolic geometry and the moduli space of maximal real quartic curves

The moduli space of smooth complex quartic curves has a complex ball quotient structure, as shown by Kondo. We shall discuss how the maximal real quartics (with four ovals) under Kondo's period map form a real hyperbolic space quotient by a discrete subgroup, with finite index reflection subgroup and explicitly computable Coxeter diagram. This is joint work with Sander Rieken.

P. Heinzner (Universität Bochum): Actions of real reductive groups on Kähler manifolds

T. Kobayashi: Symmetry breaking operators in conformal geometry and some applications

I plan to discuss a general idea on branching problems for the restriction of infinite-dimensional representations of reductive groups, and then explain the classification problem of confomally covariant symmetry breaking operators on differential forms. If time permits, I also explain some few applications.

References:
T. Kobayashi. A program for branching problems in the representation theory of real reductive groups. Progr. Math. vol. 312, pp. 277-322, 2015.
T. Kobayashi, T. Kubo, and M. Pevzner. Conformal symmetry breaking operators for differential forms on spheres, Lecture Notes in Math. vol. 2170, 2016.
T. Kobayashi and B. Speh. Symmetry Breaking for Representations of Rank

One Orthogonal Groups, Memoirs of Amer. Math. Soc. vol. 238. 2015.

A.-L. Mare (University of Regina, Canada): An affine quantum cohomology ring for flag manifolds and the periodic Toda lattice

I am planning to talk about the quantum cohomology ring of full affine Kac-Moody flag manifolds, which are the affine analogues of regular coadjoint orbits of compact Lie groups. Such rings have been investigated in papers by Guest and Otofuji (2001) and by myself (2004). However, the rigorous foundations are still to be established. The main focus of the talk would be on results that Leonardo Mihalcea and myself have obtained recently in this context. First, we proved a quantum Chevalley formula, which describes the quantum multiplication by degree-two classes. Even though these classes do not generate the entire cohomology ring, our formula can be used to define a new (associative) ring, whose ideal of relations is determined by the integrals of motion of a certain integrable system of Toda lattice type.

T. Maziacek (Center for Theoretical Physics PAS): Kirwan stratification and its physical relevance

I will present explicit results concerning Kirwan stratification of the null cone for irreducible unitary representations of connected compact semisimple groups. In particular I will describe an algorithm for finding the critical values of the squared norm of the momentum map. As an example, I will discuss representations of SU(N), which are relevant in quantum mechanics of many body systems.

K.-H. Neeb (Universität Erlangen-Nürnberg): Antiunitary representations and modular theory

We discuss a representation theoretic approach to some constructions and results in the theory of local observables (Algebraic Quantum Field Theory). Our perspective will be based on representations of Lie groups by unitary and antiunitary operators (antiunitary representations for short). Such representations arise naturally by applying Tomita-Takesaki modular theory to nets of local observables, provided certain "geometric invariance" conditions are satisfied, that ensure that modular automorphisms can be implemented geometrically. Key building blocks correspond to antiunitary representations of $\mathbb{R}^\times$ (standard subspaces and modular objects) and to antiunitary representations of the ax+b group (half-sided modular inclusions). On the mathematical side, the geometric structures specified by antiunitary representations of larger groups in terms of these building blocks are far from being well-understood.

M. Pevzner (Université de Reims): Symmetry breaking operators for differential forms

We shall present a classification of conformally covariant differential operators between the spaces of i-forms on the sphere S^n and j-forms on the totally geodesic hypersphere S^{n-1}. Using the algebraic Fourier transform for Verma modules (F-method) we find explicit formulae for these new matrix-valued operators in the flat coordinates in terms of basic operators in differential geom-

etry and classical orthogonal polynomials. This is a joint work with Toshiyuki Kobayashi and Toshihisa Kubo.

G. Pezzini (Università di Roma La Sapienza): Symmetric spaces for Kac-Moody groups

Symmetric spaces play a central role in the theory of reductive groups; their geometric and combinatorial properties have several applications, ranging from representation theory to enumerative geometry. In the talk we will report on a research project, joint with Bart Van Steirteghem, aimed at studying symmetric spaces for Kac-Moody groups, which are infinite-dimensional generalizations of reductive groups.

G. Schwarz (Brandeis University): Oka Principles and the Linearization Problem

Let G be a complex Lie group and let Q be a Stein manifold. Suppose that X and Y are holomorphic principal G-bundles over Q which admit an isomorphism Φ as topological principal G-bundles. Then the Oka principle of Grauert says that there is a homotopy Φ_t of topological isomorphisms of the principal G-bundles X and Y with $\Phi_0 = \Phi$ and Φ_1 biholomorphic. We prove generalizations of Grauert's Oka principle in the following situation: G is reductive, X and Y are Stein G-manifolds whose (categorical) quotients are biholomorphic to the same Stein space Q. We give an application to the Holomorphic Linearization Problem. Let G act holomorphically on $\mathbb{C}^n$. When is there a biholomorphic map $\Phi\colon \mathbb{C}^n \to \mathbb{C}^n$ such that $\Phi^{-1} \circ g \circ \Phi \in GL(n, \mathbb{C})$ for all $g \in G$? We describe a condition which is necessary and sufficient for "most" G-actions. This is joint work with F. Kutzschebauch and F. Lárusson.

A. Szczepkowska (University of Warmia and Mazury): On Riemannian fat associated bundles

Fat associated bundles constitute an important tool in constructing Riemannian metrics of positive and non-negative curvature. The so called fatness condition in general is rather complicated and thus was analyzed only in particular cases of associated bundles. I will remind classical results in the matter and introduce recent developments since we were able to find necessary conditions for the existence of such bundles in the case of arbitrary G-structures over homogeneous spaces. These conditions yield a kind of classification of fat bundles associated with G-structures over compact homogeneous spaces provided that the connection in a G-structure is canonical.

A. Woike (University of Warmia and Mazury): New constructions of symplectically fat bundles

It is well known that there are two general ways to endow the total space of a fiber bundle with a fiberwise symplectic form. The first one is given by the Thurston's theorem on symplectic fibrations. The second is given by the Sternberg, Weinstein and Lerman theorems on fat bundles and symplectic manifolds. We will call the symplectic fibrations constructed with the Sternberg and We-

instein theorem *symplectically fat*. This talk is devoted to new constructions of symplectically fat fiber bundles. The latter are constructed in two ways: using the Kirwan map and expressing the fatness condition in terms of the isotropy representation related to the G-structure over some homogeneous space.