



# Transformation groups in pseudo-Riemannian geometry

**ZEIT:**

29.6.2006 - 1.7.2006

**ORT:**

Max Planck Institute for Mathematics in the Sciences  
room Sophus-Lie-Seminarraum (A 01)  
Inselstraße 22  
04103 Leipzig

**PROGRAMM:****29.6.2006**

9:00 - 9:50 **Dmitri Alekseevsky (University of Hull, United Kingdom)**

**Einstein symmetric spaces**

We discuss the structure of pseudo-Riemannian Einstein symmetric spaces. In particular, we present a classification of quaternionic Kaehler and para-quaternionic Kaehler symmetric spaces with non-zero scalar curvature. We describe also some class of Ricci-flat Kaehler symmetric spaces.

10:00 - 10:50 **Jost Eschenburg (Universität Augsburg, Germany)**

**Semi-Riemannian extrinsic symmetric spaces**

10:50 - 11:30 Kaffeepause

11:30 - 12:20 **Sergio Console (Università di Torino, Italy)**

**Submanifolds and holonomy (I)**

In the present talk I survey applications of holonomic methods to the study of submanifold geometry, showing the consequences of some

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sort of extrinsic version of de Rham decomposition and Berger's Theorem, the so-called Normal Holonomy Theorem.

12:20 - 15:00 Mittagspause

15:00 - 15:50 **Carlos Olmos (Universidad Nacional de Córdoba, Argentina)**

### **Submanifold and holonomy (II)**

15:50 - 16:20 Kaffeepause

16:20 - 17:10 **Antonio José Di Scala (Politecnico di Torino, Italy)**

### **The normal holonomy group of submanifolds with parallel second fundamental form**

17:20 - 18:10 **Martin Olbrich (Georg-August Universität Göttingen, Germany)**

### **Indefinite hyper-Kähler symmetric spaces**

## **30.6.2006**

9:00 - 9:50 **Shirley Bromberg (Universidad Autonoma Metropolitana, Iztapalapa, Mexico)**

### **Left-invariant pseudo-Riemannian metrics on Lie groups (I)**

10:00 - 10:50 **Alberto Medina (Université Montpellier 2, France)**

### **Left-invariant pseudo-Riemannian metrics on Lie groups (II)**

10:50 - 11:30 Kaffeepause

11:30 - 12:20 **Michel Goze (Université de Haute Alsace , France)**

### **3-symmetric homogeneous spaces and Lie algebras graded by groups**

12:20 - 15:00 Mittagspause

15:00 - 15:50 **Michel Cahen (Université Libre de Bruxelles , Belgium)**

### **Quantizing symmetric spaces**

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15:50 - 16:20 Kaffeepause

16:20 - 17:10 **José Miguel Figueroa-O'Farrill (University of Edinburgh, United Kingdom)**

**String backgrounds from Lie groups: beyond the WZW model**

I will explain the role of Lie groups in the construction of (exact) string backgrounds. I will review the appearance of Lie groups admitting a bi-invariant metric in the so-called Wess-Zumino-Witten model and will then report on some work in progress with Nouredine Mohammedi in Tours on constructing exact string backgrounds out of left-invariant metrics on Lie groups.

17:20 - 18:10 **Said Benayadi (Université de Metz, France)**

**Metric Lie superalgebras with reductive even parts**

We study the structures of (even or odd)-metric (or quadratic) Lie superalgebras over an algebraically closed field of null characteristic. In particular, we characterize the socles and we give inductive descriptions of these Lie superalgebras.

1.7.2006

9:00 - 9:50 **Ernst Heintze (Universität Augsburg, Germany)**

**Infinite dimensional symmetric spaces of Kac-Moody type**

Quotients of a Kac-Moody group by the fixed point set of an involution are in some sense the closest generalization of Riemannian symmetric spaces to infinite dimensions. These spaces carry a natural metric of Lorentz type but otherwise share many properties with their finite dimensional counter parts.

10:00 - 10:50 **Abdelghani Zeghib (École Normale Supérieure de Lyon, France)**

**On the conformal group of Finsler manifolds**

We generalize to the Finsler case, the Lelong-Ferrand-Obata Theorem about the compactness of conformal groups of compact Riemannian manifolds, except, the standard sphere.

10:50 - 11:30 Kaffeepause

11:30 - 12:20 **Lionel Berard-Bergery (Université Henri Poincaré Nancy 1, France)**

**Invariant subspaces for the holonomy of pseudo-riemannian**

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## manifolds and applications

12:20 - 14:30 Mittagspause

14:30 - 15:20 **Vicente Cortés Suárez (Universität Hamburg, Germany)**

### **The twistor spaces of a para-quaternionic Kähler manifold**

We develop the twistor theory of  $G$ -structures for which the (linear) Lie algebra of the structure group contains an involution, instead of a complex structure. The twistor space  $Z$  of such a  $G$ -structure is endowed with a field of involutions  $\sigma$  and a  $\sigma$ -invariant distribution  $\mathcal{D}$ . We study the conditions for the integrability of  $\mathcal{D}$  and for the (para-)holomorphicity of  $\mathcal{D}$ . Then we apply this theory to para-quaternionic Kähler manifolds of non-zero scalar curvature, which admit two natural twistor spaces  $Z_1$ ,  $Z_2$ , such that  $Z_1 \cong Z_2$ . We prove that in both cases  $\mathcal{D}$  is integrable (recovering results of Blair, Davidov and Muskarov) and that  $\mathcal{D}$  defines a holomorphic (complex) or para-holomorphic (para-complex) contact structure. Furthermore, we determine all the solutions of the Einstein equation for the canonical one-parameter family of pseudo-Riemannian metrics on  $M$ . In particular, we find that there is a unique Kähler-Einstein (complex) or para-Kähler-Einstein (para-complex) metric. Finally, we prove that any Kähler or para-Kähler submanifold of a para-quaternionic Kähler manifold is minimal and describe all such submanifolds in terms of complex (complex) or para-complex (para-complex) submanifolds of  $M$  tangent to the contact distribution. (This is joint work with Dmitri Alekseevsky.)

15:20 - 15:50 Kaffeepause

15:50 - 16:40 **Charles Boubel (École normale supérieure de Lyon, France)**

### **Lorentzian flows on compact 3-manifolds**

16:50 - 17:40 **Thomas Neukirchner (Humboldt Universität Berlin, Germany)**

### **Examples of compact homogeneous Lorentz manifolds with special holonomy**

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