SYMMETRY & DIFFERENTIAL GEOMETRY

This 1-day conference on Friday 13 September 2019 is organized under the framework of the BFS/TFS project "Pure Mathematics in Norway" (https://site.uit.no/puremath/meetings)

Organizer: Dennis The (UiT), dennis.the@uit.no

Conference location: UiT The Arctic University of Norway, **Teknologibygget 2.017**

REGISTERED PARTICIPANTS

- Matthew Aadne (Stavanger)
- Torm Bæverrud (UiT)
- Fredrik Andreassen (UiT)
- Anna Escofet Pacreu (UiT)
- Pedro Gonzalez (UiT)
- Erlend Grong (Bergen)
- Hilja Huru (UiT)
- Andreu Llabres (UiT)
- Jørn Jensen (UiT)
- Johnson Kessy (UiT)
- Boris Kruglikov (UiT)
- Jakob Palmkvist (Chalmers)
- Andrea Santi (Padova)
- Eivind Schneider (Hradec Králové)
- Eldar Straume (NTNU)
- Dennis The (UiT)
- Francesca Tripaldi (Jyväskylä)
- Lode Wylleman (Stavanger)

SCHEDULE

(All talks are 45 min + 5 min questions.)

09:20	Registration & opening	
09:30	Erlend Grong	*Hamiltonians and geometry*
10:30	Jakob Palmkvist	*Tensor hierarchy algebras*
11:30	Matthew Aadne	*The Kundt criterion for Lorentzian manifolds in terms of G-structures*
12:30	Lunch	
14:00	Andrea Santi	$\mathrm{G}(3)$ *supergeometry and a supersymmetric extension of the Hilbert–Cartan equation*
15:00	Francesca Tripaldi	*Differential forms on Heisenberg groups and some applications*
16:00	Boris Kruglikov	*Blow-up and symmetry*

TITLES & ABSTRACTS

Matthew Aadne (University of Stavanger)

Title: The Kundt criterion for Lorentzian manifolds in terms of G-structures

Abstract: Kundt space-times form an important class of Lorentzian manifolds when studying degenerations of scalar curvature invariants. In this talk we shall express the criteria for a space-time to be Kundt in terms of an associated G-structure. Furthermore we shall present some properties of this G-structure and give an identification of its Lie algebra of infinitesimal automorphisms.

Erlend Grong (University of Bergen)

Title: Hamiltonians and Geometry

Abstract: We will discuss how we can study Hamiltonian systems from the point of view of symplectic invariants. In particular, we considers Hamiltonians coming from sub-Riemannian metrics. As a result, we can obtain Bonnet-Myers-type theorems for sub-Riemannian manifolds.

Boris Kruglikov (UiT The Arctic University of Norway)

Title: Blow-up and symmetry

Abstract: I will discuss the use of blow-up in CR-geometry to establish submaximal symmetry dimensions, as well as possible generalisations to other geometries.

Jakob Palmkvist (Chalmers University of Technology & University of Gothenburg)

Title: Tensor hierarchy algebras

Abstract: Tensor hierarchy algebras constitute a new class of non-contragredient Lie superalgebras, whose finite-dimensional members are the simple Lie superalgebras of Cartan type in Kac's classification. I will describe their construction by generators and relations and how they can be used to describe gauge structures in physical models, especially in extended geometry, where ordinary diffeomorphisms are unified with internal gauge transformations. The corresponding generalised Lie derivatives do not form a Lie algebra but a generalisation thereof, an L_∞-algebra, which can be derived from the tensor hierarchy algebra.

Andrea Santi (University of Padova)

Title: $G(3)$ supergeometry and a supersymmetric extension of the Hilbert–Cartan equation

Abstract: In this talk, I will show how the simple Lie superalgebra $G(3)$ can be realized as supersymmetry of various geometric structures, most importantly super-versions of the Hilbert–Cartan equation (SHC) and Cartan's involutive PDE system that exhibit $G(2)$ symmetry. I will provide the symmetries explicitly and compute, via the first Spencer cohomology groups, the Tanaka–Weisfeiler prolongation of the negatively graded Lie superalgebras associated with two particular choices of parabolics. I will discuss non-holonomic superdistributions with growth vector $(2|4, 1|2, 2|0)$ deforming the flat model SHC, and prove that the second Spencer cohomology group gives a binary quadratic form, thereby providing a "square-root" of Cartan's classical binary quartic invariant for generic rank 2 distributions in a 5-dimensional space. Finally, I will discuss superextensions of Cartan's classical submaximally symmetric models and observe a supersymmetry dimension gap phenomenon. This is a joint work with Boris Kruglikov and Dennis The.

Francesca Tripaldi (University of Jyväskylä)

Title: Differential forms on Heisenberg groups and some applications

Abstract: The Rumin complex was introduced on Heisenberg groups as an alternative to the de Rham complex, due to its properties which make it better suited to the subRiemannian setting, and was later extended to arbitrary Carnot groups. One important application of this complex involves the computation of $\ell^{q,p}$ cohomology groups. In fact, it is a well-known fact that on a Euclidean ball, every closed differential form ω has a primitive whose L^q norm is bounded by the L^p norm of ω (for suitable exponents p and q). The use of the Rumin complex allows us to prove analogous results in subRiemannian Heisenberg groups.
