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Non-standard invariant operators on quaternionic geometries and curved Casimir operators

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My talk will be devoted to a certain family of non-standard operators on quaternionic manifolds. Quaternionic structures belong to the wide class of parabolic geometries and thus a variety of algebraic tools can be applied in the study of these geometries and of invariant differential operators. For the homogeneous model, the description of invariant operators can be reduced to the study of homomorphisms of (generalized) Verma modules, which are understood in many cases. This concept can be extended to curved geometries by considering the so-called semi-holonomic
Verma modules, but this does not lead to a complete description. There are
a few operators, which do not arise in this simple algebraic way. Apart from the critical powers of the Laplace operator on even dimensional conformal manifolds, the above mentioned invariant operators on quaternionic geometries provide examples of this situation.
In the end of the lecture, I will describe a new effective approach to construction of invariant operators, which was recently found by Andreas Cap and Vladimir Soucek. They proved that the Casimir operator naturally extends to an invariant differential operator on arbitrary parabolic geometries and and it can be used to construct invariant operators between
various types of natural bundles.

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