KILLING FORMS ON KERR-NUT-(A)dS SPACES OF EINSTEIN-SASAKI TYPE

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Abstract. In certain scaling limits the higher-dimensional Euclideanized Kerr-NUT-(A)dS metrics are related to the Einstein-Sasaki ones. The complete set of Killing forms of the Einstein-Sasaki spaces are presented. It is pointed out the existence of two additional Killing forms on these spaces associated with the complex volume form of the Calabi-Yau cone manifold. As a concrete example we present the complete set of Killing-Yano tensors on the five-dimensional Einstein-Sasaki $Y(p,q)$ spaces.

1. Introduction

In the last time the properties of higher-dimensional black holes have become of large interest. The most general known higher-dimensional metrics describing rotating black holes with NUT parameters in an asymptotically AdS spacetimes were described in [6]. The general Kerr-NUT-AdS metrics have $(2n - 1)$ non-trivial parameters where the spacetime dimension is $(2n + 1)$ in the odd-dimensional case and $(2n)$ in the even dimensional case.

In certain scaling limits [12, 13] these metrics are related to the Einstein-Sasaki ones. On the other hand the Einstein-Sasaki geometries have been the object of much attention in connection with the supersymmetric backgrounds relevant to the AdS/CFT correspondence.

The Kerr-NUT-(A)dS metrics possess isometries and hidden symmetries encoded in a series of Killing vectors and Stäckel-Killing tensors [6]. These symmetries are connected with a set of conserved quantities which are functionally independent, in involution, and guarantee the complete integrability of the geodesic motions [11, 15, 18].

In the case of Sasaki spaces the hidden symmetries are derived from the characteristic Sasakian one-form and a tower of Killing-Yano and conformal Killing-Yano tensors can be constructed [12].