Spin(7) Geometry with Torsion

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Abstract

Spin structures have wide applications to mathematical physics, in particular to quantum field theory. For the special class Spin(7) geometry, there are different approaches. One of them is constructed by holonomy groups. According to the Berger classification (1955), the Spin(7) group is one of these holonomy classes. Firstly, it is presented its properties. After that, torsion which is another important term in superstring theory will be geometrically introduced and related to Spin(7) geometry.

Let M be an 8-dimensional manifold with the Riemannian metric g and structure group $G \subset SO(8)$. The structure group $G \subset Spin(7)$, then it is called M admits $Spin(7)$-structure. M. Fernandez [1] classifies the all types of 8-dimensional manifolds admitting Spin(7)-structure. In general, torsion-free Spin(7) manifold are studied considerably.

On the other hand, manifolds admitting Spin(7)-structure with torsion have rich geometry as well. Locally conformal parallel structures has bee studied for a long time with Kähler condition is the oldest one. By means of further groups whose holonomy is the exceptional, the choices of the G_2 and Spin(7) deserves to attention. Ivanov [3], [4], [5] introduces a condition when 8-dimensional manifold admits locally conformal parallel Spin(7) structure.

Salur and Yalcinkaya [6] studied almost symplectic structure on Spin(7)-manifold with 2-plane field. Then, Fowdar [2] studied Spin(7) metrics from Kähler geometry. In this research, we introduce 8-manifold equipped with locally conformal Spin(7)-structure with 2-plane field. Then, almost Hermitian 6-manifold can be classified by the structure of M.

Keywords: Spin(7) structure, Torsion , Almost Hermitian structure
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