∗-RICCI SOLITONS ON (ε)−PARA SASAKIAN 3-MANIFOLDS

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Abstract

In the present paper we study ∗-Ricci solitons in (ε)−para Sasakian manifolds and prove that if an (ε)−para Sasakian 3-manifold with constant scalar curvature admits a ∗-Ricci soliton, then the ∗-Ricci soliton is steady if and only if $£_V \xi$ is g-orthogonal to ξ provided $a =$Trϕ is constant. Beside these, we study gradient ∗-Ricci solitons on (ε)−para Sasakian 3-manifolds.

2000 *Mathematics Subject Classification:* $53C15, 53C25$.

Key words: (ε)−para Sasakian manifolds, ∗-Ricci solitons, gradient ∗-Ricci solitons, ∗-Einstein manifold.

1 Introduction

In this paper, we introduce a new type of Ricci solitons, called *∗-Ricci solitons in (ε)−para Sasakian manifolds* with indefinite metric which play a functional role in contemporary mathematics. The properties of a manifold solely depend on the nature of the metric defined on it. With the help of *indefinite metric*, A. Bejancu and K. L. Duggal [1] introduced *(ε)−Sasakian manifolds*. Also, Xufeng and Xiaoli [18] showed that *every (ε)−Sasakian manifold must be a real hypersurface of some indefinite Kähler manifold.* In 2010, Tripathi et.al[14] studied *(ε)−almost paracontact manifolds*, and in particular, *(ε)−para Sasakian manifolds*. They introduced the notion of an *(ε)−para Sasakian structure*. Since Sasakian manifolds with indefinite metric play significant role in physics [8], our natural trend is to study various contact manifolds with indefinite metric.

A Ricci soliton is a generalization of an Einstein metric. We recall the notion of Ricci soliton according to [5]. On manifold M, a Ricci soliton is a triple (g, V, λ) with g a Riemannian metric, V a vector field, called potential vector field and λ a real scalar such that

$$£_V g + 2S + 2\lambda g = 0, \tag{1}$$

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