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STATIC PERFECT FLUID SPACE-TIME ON ALMOST KENMOTSU MANIFOLDS

HUCHCHAPPA ARUNA KUMARA, VENKATESHA VENKATESHA AND DEVARAJA MALLESHA NAIK

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Abstract. In this work, we intend to investigate the characteristics of static perfect fluid space-time metrics on almost Kenmotsu manifolds. At first we prove that if a Kenmotsu manifold M is the spatial factor of static perfect fluid space-time then it is η-Einstein. Moreover, if the Reeb vector field ξ leaves the scalar curvature invariant, then M is Einstein. Next we consider static perfect fluid space-time on almost Kenmotsu $(\kappa,\mu)'$-manifolds and give some characteristics under certain conditions.

MSC: 53C25, 53C20, 53C15
Keywords: Almost Kenmotsu $(\kappa,\mu)'$-manifold, Einstein manifold, Kenmotsu manifold, perfect fluid, static space-time

1. Introduction

Einstein introduced a geometric theory for gravitation, which is now widely known as general relativity. The general theory of relativity provides light upon on interplay of physics and space-time geometry. Static space-times are unique and significant global solutions to Einstein equations in general relativity. Let $\widehat{M} = M \times_\nu \mathbb{R}$ be a static space-time endowed with metric

$$\widehat{g} = g - \nu^2 \mathrm{d}t^2$$

where (M, g) is a noncompact, connected, oriented Riemannian manifold and $\nu\colon M \to (0, +\infty)$ is a smooth warped function on M. The Einstein equation with perfect fluid as a matter field is given by

$$\widehat{\mathrm{Ric}} - \frac{\widehat{s}}{2}\widehat{g} = \mathcal{T} \tag{1}$$

the energy-momentum stress tensor $\mathcal{T} = -\vartheta f^2\,\mathrm{d}t^2 - \rho g$ of a perfect fluid, where $\widehat{\mathrm{Ric}}$ and $\widehat{s}$, stands for, respectively, the Ricci tensor and the scalar curvature of the metric $\widehat{g}$. Moreover, the smooth functions ϑ and ρ are energy density and pressure