Iintroduction to $f(R)$ gravity and applications

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Abstract

Recent cosmological data show that the universe is expanding at an accelerating rate. This contradicts the results of general relativity, at least for a Universe composed only of matter. To attack this problem, two general ways have been taken: introducing a new type of energy (such as the cosmological constant Λ, dark energy) or modifying the theory of gravitation.

So, several extensions to the theory of gravitation were proposed in order to preserve the positive results of Einstein's Theory of general relativity. The simplest extension is the so called $f(R)$ gravity which consists in replacing the Ricci scalar R by a function f of it.

Here, we review $f(R)$ gravity, a modification to general relativity, are all about modifying the Einstein-Hilbert action and taking it to higher orders in the Ricci scalar. There are three versions of $f(R)$ modified gravity: Metric, Palatini and Metric-affine gravity.

In this work we will briefly review these versions of $f(R)$ modified gravity. We will be essentially interested in examining how does $f(R)$ gravity affects the behavior of a charged compact star.

Keywords: General Relativity, Extended theory of gravity, $f(R)$ gravity, Charged compact star.