Cosmological constant of GRT as a radial function in dependence of velocity

- A short notice -

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Abstract:

Under special circumstances cosmological „constant“ of GRT can be formulated as a function in dependence of radial term. This calculation will be shown. In fact this system of physical ideas is now described only for local state of Schwarzschild-lineelement with cosmological variable but it can be easily developed to cosmic terms.

Key-words: Cosmological constant; Einstein-equation; gravity-equation; Schwarzschild-solution, flat space-time; Planck-length; radial function.

1. Introduction:

Since Einstein introduced this cosmological term Λ to correct and complete his gravity equations in 1917 ad hoc for logically consistent description in four spacetime dimensions [1.], this term plays an important role in description of universe in its global states, particularly as a form of „dark energy“, which determines the observed acceleration of cosmic expansion or can be interpreted as a form of a vacuum-energy. Mostly this term is considered as a constant but, as is shown, it also can be interpreted as a function in dependence of radius.

2. Calculation:

If the Schwarzschild-lineelement of a local spacetime is written with cosmological constant [2.]:

$$ds^2 = \frac{dr^2}{1 - \frac{2 \cdot M}{r} - \frac{\Lambda \cdot r^2}{3}} + r^2 \cdot (d\theta^2 + \sin^2(\theta) \cdot d\phi^2) - c^2 \cdot dt^2 \left(1 - \frac{2M}{r} - \frac{\Lambda \cdot r^2}{3}\right) \qquad (1.)$$

where: $M=\frac{2 \cdot G \cdot m}{c^2}$ is Schwarzschild-radius with m central-matter-mass of gravity-field which causes the material part of the gravity-field [3.] and the limit is now done for $m=0 \Rightarrow M=0$, then the lineelement is describing a local flat form of spacetime without a central-mass but with the cosmological term Λ . From materia its empty like a geon, first formulated by Wheeler [4.]. This g- field now can be described far from its empty source by setting:

$ds^2 = d\,r^2{}_{PL}$ (far out in the wilderness) as its physical minimal size.

This field then can be written as:

$$dr^2{}_{PL} = \frac{dr^2}{\left(1-\frac{\Lambda \cdot r^2}{3}\right)} - c^2 \cdot dt^2 \cdot \left(1-\frac{\Lambda \cdot r^2}{3}\right) \qquad (2.)$$

which leads directly to:

$$\Lambda = \frac{3}{r^2} + \frac{3}{2 \cdot r^2} \cdot \frac{dr^2{}_{PL}}{c^2 \cdot dt^2} \pm \frac{3}{r^2} \sqrt{\frac{dr^4{}_{PL}}{4 \cdot c^4 \cdot dt^4} + \frac{v^2}{c^2}} \qquad (3.)$$

where in local spacetime is defined:

$\frac{dr^2}{c^2 \cdot dt^2} := \frac{v^2}{c^2}$. which can be interpreted as: $\frac{1}{c^2} \cdot \left(\frac{dr}{dt}\right)^2 = \frac{v^2}{c^2}$. (3a.)

<u>3. Conclusion:</u>

Cosmological term Λ can be written as a function, which depends local on the variables of velocity v and radial variable r resp. timelike differential dt . In „classical“ GRT without Planck-length as a fundamental minimal length with the continuity condition $\hbar \Rightarrow 0$, this term reduces then to:

$$\Lambda = \frac{3}{r^2} \cdot \left(1 \pm \frac{v}{c}\right) \qquad (4.)$$

If this function can be also interpreted as a global cosmic description, then dark energy can‘t be a constant but must depend from cosmical expansion-radius and in interpretation from cosmical expansion-velocity.

Solution: $\Lambda = \Lambda(r, v) \neq const.$ (5.)

4. Summary:

The cosmological term Λ of GRT can be written as a function in dependence from velocity and of radius.This result comes from explanation of a local examination in Schwarzschild-lineelement with cosmological-term but can be developed in an explanation to global cosmic expansion like is actually written and observed in [5.] .

5. Comment:

Since Ricci-scalar is coupled with cosmological term via

$$\Lambda=\frac{\chi \cdot T-R}{4} \tag{6.}$$

where χ is Einstein-gravitational constant and T is $diag \sum_{1}^{4} T_{i}^{k} ; i=k$, Ricci-scalar then can also be written as a function from distance r and velocity v .With the assumption $m=0 \Rightarrow M=0$ there is also $T=0$. This leads to a result for Ricci-scalar as a function of $R(r, v, dt)$:

$$R=\frac{-12}{r^{2}}-\frac{6}{r^{2}} \cdot \frac{dr^{2}{}_{PL}}{c^{2} \cdot dt^{2}} \pm \frac{12}{r^{2}} \cdot \sqrt{\frac{dr^{4}{}_{PL}}{4 \cdot c^{4} \cdot dt^{4}}+\frac{v^{2}}{c^{2}}} \quad . \tag{7.}$$

which reduces in classical GRT with the continuity condition $\hbar \Rightarrow 0$ to:

$$R=\frac{-12}{r^{2}} \cdot\left(1 \pm \frac{v}{c}\right) \quad . \tag{8.}$$

6. References:

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7.Verification:

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