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Relative Velocity of Material Change into a 3D Quantum Vacuum

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According to the quantum theory of Max Planck quantum vacuum is build up from the 3 dimensional quanta of space l_p^3. In this view massive objects and elementary particles move within a 3 dimensional physical space originated from the three dimensional quantum vacuum. It is shown in this paper that relative velocity of material change can be described within a 3 dimensional Euclidean space where time is merely a numerical order of material change, i.e., motion in a 3D space.

KEYWORDS: 3D Quantum Vacuum, Energy Density of Quantum Vacuum, Relativity.

1. INTRODUCTION

In this article, starting from the idea that space has a granular structure at the Planck scale is introduced a model of a three-dimensional (3D) quantum vacuum composed by elementary packets of energy having the size of Planck volume and is defined by a energy density which, in the absence of matter, is at the maximum and is given by the total volumetric energy density which coincides with the Planck energy density ρ_{PE}:

$$\rho_{\mathrm{PE}} = \frac{m_p * c^2}{l_p^3} \tag{1}$$

In the three-dimensional quantum vacuum, the appearance of a given massive object corresponds with a given diminishing of the energy density of quantum vacuum ρ_{qvE} on the surface of the material object. By the presence of a given massive object of mass m energy density ρ_{qvE} will diminish on its surface respectively to the amount of mass m and its volume V:

$$\rho_{\mathrm{qvE}} = \rho_{PE} - \frac{m \cdot c^2}{V} \tag{2}$$

where

$$V = \frac{4}{3} \cdot \pi \cdot R^3 \tag{3}$$

R is the radius of massive object under consideration. Rate of clocks and velocity of material changes decreases with decreasing of energy density of quantum vacuum. With increasing of the energy density of quantum vacuum rate of clocks and velocity of material changes is increasing.

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Relation between clock rate τ' on the surface of the massive object at the point A and clock rate τ on the distance d above the surface at the point B is following:

$$\tau' = \frac{\tau}{\sqrt{1-(2GM/(R*c^2))}} \tag{4}$$

where

$$R = d + r \tag{5}$$

G is gravitational constant, M is the mass of the stellar object and r is the radius of the stellar object.

Relation between clock rate τ' and velocity of the material change on the surface of the massive object at the point A and clock rate τ and velocity of the material change on the distance l under the surface at the point B is following:[1]

$$\tau = \tau' \left(1 - \frac{8\pi}{3} * G * \frac{\rho}{c^2} * R * l\right) \tag{6}$$

where G is gravitational constant, ρ is the density of the upper stratum of the earth 2850 kg/m^3, c is the light speed, R is radius of the planet Earth.

According to the Newton shell theorem mass of the shell above the point B does not influences gravitational force on the object positioned at the point B. Energy density ρ_{qvE} of quantum vacuum at the point B is following:

$$\rho_{\mathrm{qvE}} = \rho_{\mathrm{PE}} - \frac{m \cdot c^2}{V} \tag{7}$$

where m is the mass of the stellar object below the point B and V is the volume of the stellar object below the point B without the shell above. Energy density of quantum vacuum is lowest on the surface of the massive object and increases going above the surface and under the surface towards the centre of the stellar object.

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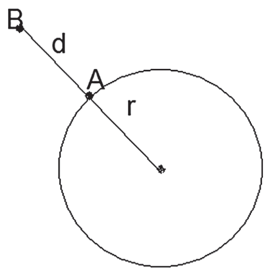


Picture 1. Different rate of clocks on the surface of stellar object and above it.

Inside Schwarzschild radius r_s (8) Newton shell theorem is not valid any more

$$r_s = \frac{2Gm}{c^2} \tag{8}$$

Energy density inside Schwarzschild radius is at the minimum and it is constant. Combining Eqs. (2), (3) and (8) we will get following equation for energy density of quantum vacuum inside Schwarzschild radius:

$$\rho_{\mathrm{qvE}} = \rho_{\mathrm{PE}} - \frac{3m \cdot c^2}{4\pi \cdot ((8 \cdot G^3 \cdot m^3)/c^6)} \tag{9}$$

out of which follows:

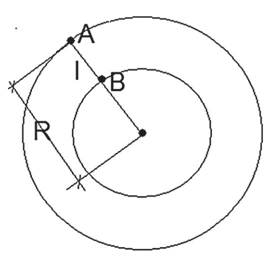
$$\rho_{\mathrm{qvE}} = \rho_{\mathrm{PE}} - \frac{3c^8}{32\pi \cdot G^2 \cdot m^2} \tag{10}$$

where m is the 3.2 masses of the sun, c is the light speed and G is the gravitational constant.

In outer space far away form massive objects where energy density of quantum vacuum is at the maximum following Eq. (1) relative velocity of material change is following: stationary observer O is on the point A in a 3D quantum vacuum. Moving observer O' along the axis X is on the moving point B in a 3D quantum vacuum. Formalism for relation between spatial coordinates X, Y and Z is following:

$$X' = X - v * \tau$$
$$Y' = Y \tag{11}$$
$$Z' = Z$$

where v is the velocity of the moving observer O' measured by the stationary observer O and τ is the proper time



Picture 2. Different rate of clocks on the surface of stellar object and under it.

of the observer O. Formalism for relation between proper time τ of the observer O and proper time τ' of the observer O' is derived from the Selleri equation (12) where times t and t' are changed by the proper times τ and τ':[2,3]

$$t' = t * \sqrt{1 - \frac{v^2}{c^2}} \tag{12}$$

$$\tau' = \tau * \sqrt{1 - \frac{v^2}{c^2}} \tag{13}$$

Formalism for delta tau $\Delta\tau$ between τ and τ' is following:

$$\Delta\tau = \tau - \tau' \tag{14}$$

Formalisms for calculating distance between observer O and observer O' are following:

$$d_{\mathrm{AB}}^2 = (v * \tau)^2 = dx^2 + dy^2 + dz^2 \tag{15}$$

$$d_{\mathrm{BA}}^2 = (v * (\tau' + \Delta\tau))^2 = dx^2 + dy^2 + dz^2 \tag{16}$$

For a rest observer O in a rest inertial system o far away from massive objects a given moving inertial system o' with velocity v has its kinetic energy $K.E.$:

$$K.E. = 0.5m \cdot v^2 \tag{17}$$

where m is the mass of the moving inertial system and v is its velocity respectively to the observer O. Energy density of quantum vacuum in the moving inertial system o is diminished and so rate of clocks is diminished too:

$$\rho_{\mathrm{qvE}} = \rho_{\mathrm{PE}} - \frac{m \cdot c^2 + 0.5m \cdot v^2}{V} \tag{18}$$

where m is the mass of the moving inertial system and v is its velocity respectively to the observer O.

Out of Eq. (13) follows Eq. (14):

$$\rho_{\mathrm{qvE}} = \rho_{\mathrm{PE}} - \frac{m * (c^2 + 0.5v^2)}{V} \tag{19}$$

2. DISCUSSION

In this article it is shown that relative velocity of material change rate of clocks including depends exclusively on the energy density of quantum vacuum. In this model time is not existing any more as a 4th coordinate of space, the only existing times are proper tau times τ and τ' which are valid for both observers O and O'. GPS confirm different rate of clocks on the surface and on the orbit station is valid for observer O' on the orbit station and observer O on the surface of the planet. A given proper times τ and τ' are not a physical dimensions in which change run; they are merely a numerical orders of changes which run in a 3D quantum vacuum.

In this model there is no length contraction along axis X which would lead to the contradiction, namely in a moving inertial system horizontal photon clock positioned

ARTICLE

along the axis X would shrink and would have faster rate than identical photon clocks positioned vertically.[4]

Time travels into the past and into the future are out of question, one can travel in space only. Past, present and future exist only as a numerical order of change which runs in a 3D quantum vacuum. In this perspective universe does not run in time, on the contrary time we measure with clocks is a numerical order of universal change.[5–7]

3. CONCLUSIONS

May Planck has postulated fundamental grains of space are 3 dimensional. On his foundation "relativity" in a sense of a relative velocity of material changes which run in a 3D quantum vacuum can be described within a 3D Euclidean space. Relative difference between clocks rate and velocity of material change depends exclusively on the energy density of quantum vacuum.

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