FEEDING THE UNIVERSE, QUALIA AND NEUTRINO

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Abstract

Based on the quantum modification of the general relativity (Qmoger), it is shown, that Vacuum is continuously feeding the universe and partially merge with it, not unlike an ovary with a fruit. Subjective experiences (qualia) are considered in frames of the Qmoger theory. A relation is found between qualia and the neutrino oscillations.

1. Introduction

The level of a civilization, to a high degree, is determined by its cosmology. The phenomenon of qualia (subjective experiences) is the most sophisticated achievement of the developing universe. In order to understand the physical nature of qualia, we need an adequate cosmology.

In the quantum modification of the general relativity (Qmoger), in contrast with the conventional Big Bang theory (BB) [1], the matter (energy) is continuously produced by the Vacuum. The Qmoger equations differs from the Einstein equations of the general relativity by two additional terms, responsible for production (absorption) of matter [2-4]. These works were presided by invention of a new type of fluid, namely the dynamics of distributed sources-sinks [5, 6], which, in turn was presided by exact analytical solution of the (1+1)-dimensional Newtonian gravitation [7]. Qmoger theory was motivated by many deficiencies of BB [1-4, 8]. The additional terms in Qmoger equations take into account the space-time divergency (stretching), the effect of which is comparable with the effect of the space-time curvature in the Einstein theory. Qmoger theory is in good quantitative agreement with cosmic data, without fitting. At the same time, Qmoger eliminates major controversies of BB, such as the critical density of the universe, dark energy (cosmological constant) [9] and inflation [10]. The situation with BB now is not unlike the situation with the geocentric model of Ptolemy [11]. BB inspired many important observations and useful theoretical works. But the theory, during almost 100 years of attempts to save the BB from contradictions with cosmic data, becomes too cumbersome and involves a lot of additional assumptions. It is time to move on. Qmoger is not limited to cosmology. In previous work [12] an explanation of qualia was initiated in frame of Qmoger. In this paper we are going one step deeper into details. Particularly, it turns out that qualia is related to the mysterious particle neutrino and its oscillations [13].

2 Quantum modification of general relativity (Qmoger)

The simples situation with continuous production of matter from the Vacuum is when the averaged density of matter is constant: $\rho = \rho_0$. In more general situation [14] the averaged density of enthalpy is constant: $w = \varepsilon + p = w_0$, where $\varepsilon = \rho c^2$ is the energy density, p is the pressure and c is the speed of light.

The pressure can be high in stars. But the averaged pressure in the universe is small and the dust approximation ($p = 0$) is useful in many situations. In this case, the main parameters in the Qmoger theory are: the gravitational constant G, c and ρ_0. From these parameters we have unique length scale:

$$L_* = \frac{c}{(G\rho_0)^{1/2}} \tag{1}$$

We use value $\rho_0 \approx 2.6 \cdot 10^{-30} gcm^{-3}$, which, according to WMAP [15], includes ordinary and dark matter. We do not include the dark energy, which does not exist in Qmoger (see below). (1) gives $L_* \approx 76$ billion light years (bly) [3, 4], which is comparable with the current size of the visible universe $a_0 \approx 46.5$ bly. Qmoger equations have corresponding exact analytical solution [16, 3, 4] for the scale factor a in homogeneous and isotropic universe:

$$a(\tau) = a_0 \exp[H_0\tau - 2\pi(\tau/L_*)^2],\ \tau = ct, \tag{2}$$

where H_0 is the Hubble constant, divided by c, which is the current value of function $H(\tau) = d(\ln a)/d\tau$. Remarkably, $L_* H_0 \approx 2.6$. The temporal scale H_0^{-1} and the eternal scale L_* are of the same order because $a(\tau)$ is currently relatively close to its maximum (see below). In the isenthalpic case ($w = w_0$), which takes into account radiation [14], Qmoger equations have the same solution (2) with $L_w = c^2 (Gw_0)^{-1/2}$instead of L_*. These two scales are very close because averaged pressure in small.

Solution (2) does not have any fitting parameters and is in good quantitative agreement with cosmic data [16, 3, 14]. This solution eliminates the mentioned above major controversies - critical density of the universe, dark energy (cosmological constant) and inflation.

In nonrelativistic regime, Qmoger reproduces Newtonian dynamics, but the speed of the gravitational waves can be different from c [16]. This give us a hint, that gravitons have mass (unlike photon). With scale (1) we associate gravitons with mass $m_0 = \hbar/(cL_*) \sim 0.5 \cdot 10^{-66} gram$ and electric dipole moment (EDM) $d \sim m_0^{1/2} l_P^{3/2} c \sim 2 \cdot 10^{-72} gram^{1/2} cm^{1/2} s^{-1}$[3, 4], where $l_P = \left(\hbar G/c^3\right)^{1/2} \approx 1.6 \cdot 10^{-37} cm$ is the Planck scale. EDM of background gravitons can explain the baryon asymmetry of the universe [17] (prevalence of particles over antiparticles) in terms of breaking the reflection symmetry [18]. It is shown [3, 4]], that such particles form quantum condensate [19] even for high temperature. The concentration of particles n and characteristic scale are:

$$n = \frac{\rho_0}{m_0} \approx 5 \cdot 10^{36},\ l = n^{-1/3} \approx 2.7 \cdot 10^{-13} cm. \tag{3}$$

3. Feeding the universe

According to (2), the universe was born in the infinite past ($a(-\infty) = 0$) from small fluctuation. But, formula (2) is solution of Qmoger differential equations for the space-time metric, which is assumed to be smooth. The smooth metric we can expect only starting with condition $a = l_P$. It is natural to associate this condition with the beginning of the universe in frame of the Qmoger theory. From that condition, using (2), we get time [4]: $t_1 \approx -327$ billion years. The mass of the embryonic universe can be estimated by $M_1 = \rho_0 l_P^3 \approx 10^{-128} gram$. This result suggest existence of particles (or quasiparticles) with much smaller mass than m_0 (see also below). Any such particle we will call vacumo. It seems reasonable to suggest, that Vacuum is feeding universe with vacumos.

The next important step in the evolution of the universe is the production of gravitons with indicated above mass m_0. The corresponding condition is: $a = l$. In this case, (2) gives [4] : $t_2 \approx -284$ billion years. So, it took about 43 billion years of nurturing the universe to accommodate it for production of gravitons. The union of the universe with the part of the Vacuum, attached to it and equipped with the same smooth metric, we will call Vuniverse. This is not unlike the situation with the ovary of a fruit. It seems natural, that the feeding comes from an external part of the Vacuum, which do not have to be equipped with a metric. The mature Vuniverse transforms vacumos into gravitons, which form the background quantum condensate. Vuniverse combines the material universe with a nonmaterial entity, which we will call metrical Vacuum. This will help to explain qualia and other mysterious phenomena (see below).

Size of the universe (2) riches the maximum $a_{\max} \approx 1.32\ a_0$ at time $t_{\max} = (L_*^2 H_0)/(4\pi c) \approx 12.57$ billion years. It was shown [16], that universe is globally stable during expansion ($-\infty < t < t_{\max}$). But, after that it becomes unstable and additional investigation is needed for evolution of the universe at $t > t_{\max}$.

4. Feeding the humankind

In the previous section we discuss how the Vacuum feeds the universe. That supply of energy eventually reaches the humankind indirectly, particularly, in the form of solar radiation or petroleum. But we need more sources of energy. If we can manage to squeeze the background dipolar condensate of gravitons, say, by using electromagnetic field, we can get an eternal source of energy on Earth.

5 New quantum scaling

During formation of galaxies, in stars and in hot planets (Jupiter, Saturn), the local density of matter becomes large and new particles (including photons) are synthesized. In these processes, instead of the gravitational constant, the Planck constant ħ becomes important. From c, ħ and ρ_0, we now have unique scale:

$$l_* = \left(\frac{\hbar}{c\rho_0}\right)^{1/4} \approx 10^{-2} cm. \tag{4}$$

We can rewrite (3) in the form:

$$l_* = \frac{\hbar}{cm_*},\ m_* = \rho_0 l_*^3 = \rho_0^{1/4}\left(\frac{\hbar}{c}\right)^{3/4} \approx 3.1326\times 10^{-36} gram \approx 1.76\cdot 10^{-3} eV/c^2. \tag{5}$$

So, scale l_* corresponds to the Compton wavelength of a particle with mass of background matter occupying volume of size l_*. This indicates a mechanism of formation new particles from background matter. Mass m_* is determined uniquely by the new scaling. Apparently, it is a typical mass of the first generation particles, produced by indicated mechanism from the background condensate. Among the experimentally observed particles, neutrino is the best candidate for being produced in this way. Indeed, mass m_* corresponds to experimental bound for the mass of neutrino [13]. The time scale:

$$t_* = \left(\frac{\hbar}{\rho_0}\right)^{1/4} c^{-5/4} \approx 3.3 \cdot 10^{-13} s \tag{6}$$

could be associated with formation and acceleration ($c/t_* \sim 8.46 \cdot 10^{22} cms^{-2}$) of neutrino, as well to the neutrino oscillations [13]. The physics of these oscillations can be related to interaction of neutrino with the background condensate of described above ultralight dipolar gravitons. The averaged number of gravitons interacting with such neutrino can be estimated by $N_* = m_*/m_0 \sim 10^{30}$. During a flight, neutrino can create waves in the background and temporary carry along coherent groups of gravitons. This will influence the effective mass and the flavor of neutrino [13]. This is an example of interface between dark and ordinary matter (Idom), introduced in Ref. 12 (see below).

The new scaling predict EDM for neutrino or similar particles:

$$d = \hbar^{3/2} c^{1/2} \rho_0^{-1/2} \approx 5.8 \cdot 10^{-11} g^{1/2} cm^{5/2} s^{-1}, \tag{7}$$

which is much bigger that indicated above EDM of graviton. Note, that Qmoger theory with its seeping gravitons [3, 4] could lead to correction of some deficiencies of the quantum field theory, particularly, the inequivalent representations [20]. Indeed, the active background can eliminate unstable representations of reality.

6. Qualia

In the light of presented above results, we can expand the explanation of subjective experiences (qualia) in terms of interaction between background dipolar condensate and the neuron system [12]. The action potentials of living cells, particularly, neurons [21], create traps and coherent patterns in the condensate, which we actually see and feel (see below). The new scale l_* (4) seems to be appropriate for the size of the neuron cluster, which produces sophisticated qualia. The necessary for qualia huge number of degrees of freedom is supplied by the indicated above number of gravitons N_*. It would not be surprising if the oscillating neutrino, which interacts with gravitons (see above), play a role in qualia along with the action potential of neurons.

By manipulating with action potentials and quantifying qualia response, we can open a new window into the dark sector of matter, including gravitons.

The introduced above concept of Vuniverse, which combines the material universe with the metric Vacuum, helps us to understand the nonmaterial part of introduced in Ref.12 interface between dark and ordinary matter (Idom). Indeed, it seems, that the location of qualia with its components (sensations, emotions and reflections) is in the metrical Vacuum. This nonmaterial entity is hovering over the matter, particularly, over the neuron system. Having the Qmoger equations for the metric and some information about the neural systems, provided by the neuroscience, we can do a quantitative study of qualia.

7. Conclusions

Qualia and neutrino oscillations are just two examples of Idoms - interfaces between dark and ordinary matter. We can expect that many other mysteries of physics and biology will be explained in terms of the described above Qmoger theory and metrical Vacuum.

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