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Energy does not have a Gravitational Mass (Flaw of the Einstein's gravitational theory)

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ABSTRACT
According to the Einstein's gravitational theory, the zero-point energy in the vacuum will collapse the universe into a gravitational singularity if the cut-off frequency of the zero-point field is the Plank frequency. But, according to the ZPF gravity theory proposed by the author, the energy dose not have a gravitational mass as claimed by the Einstein's gravitational theory. From which, it is considered that Einstein's gravitational theory is not correct.

Keywords: Einstein's gravitational theory; equivalence principle; gravitational mass; zero-point energy; ZPF gravity

INTRODUCTION

The mass of an object determines its acceleration in the presence of an applied force. The inertia and the inertial mass describe this property of physical bodies at the qualitative and quantitative level respectively. According to Newton's second law of motion, if a body of fixed mass m is subjected to a single force F, its acceleration a is given by F/m. A body's mass also determines the degree to which it generates and is affected by a gravitational field. This is sometimes referred to as gravitational mass. Repeated experiments since the 17th century have demonstrated that inertial and gravitational mass are identical; since 1915, this observation has been incorporated a priori in the equivalence principle of general relativity.

According to the Einstein's relativity theory, an energy has an equivalent mass and it has a gravitational mass as shown Einstein's gravitational equation.

Zero-point energy (ZPE) is the lowest possible energy that a quantum mechanical system may have. Unlike in classical mechanics, quantum systems constantly fluctuate in their lowest energy state as described by the Heisenberg uncertainty principle (i.e., the ZPF field). If the cut-off frequency of zero-point energy is equal to the Plank frequency, the radius of curvature of the universe would be expected to be orders of magnitude smaller than an atomic nucleus, which means the universe will collapse into a singularity if the zero- point fluctuation of energy (ZPF) were real. This is a paradox of ZPF energy field of the universe. Based on Sakharov's idea, Puthoff proposed a gravitation mechanism by an interaction between elementary particles and the ZPF field. According to his idea, the author proposed the ZPF gravity theory [1] and it shows that an energy dose not have an equivalent gravitational mass.

CURVATURE OF THE UNIVERSE DUE TO THE ZPF FIELD

Einstein's gravitational equation can be given by [2]

$$R^{\mu\nu} = -\kappa(T^{\mu\nu} - (1/2)g^{\mu\nu}T), \quad (1)$$

where $R^{\mu\nu}$ is a Ricci tensor, $T^{\mu\nu}$ is an energy-momentum tensor and κ is the Einstein's gravitational constant.

Then we have [2]

$$R_{44} = -\kappa(T_{44} - (1/2)g_{44}T), \quad (2)$$

where $T_{44} = -\rho c^2 = -\varepsilon$ and ε is an energy density.

As we can write $R_{44} \approx (1/2)\Delta g_{44}$, then Eq.(2) becomes

$$\Delta g_{44} \approx 2\kappa[\varepsilon + (1/2)g_{44}T], \quad (3)$$

Quantum physics shows that the vacuum is filled with zero-point fluctuation of energy. The total, frequency integrating energy density of the ZPF can be given by [3]

$$\rho_E = (\hbar/8\pi^2c^8)\omega_c^4, \quad (4)$$

where ω_c is a cut-off frequency of the zero-point field in the vacuum.

Since it is assumed that ω_c must actually be on the order of the Plank frequency given by

$$\omega_p = [c^5/\hbar G]^{1/2} \approx 3\times10^{43}/s, \quad (5)$$

then the radius of curvature of the universe would be expected to be orders of magnitude smaller than an atomic nucleus, which means the universe will collapse into a singularity if the ZPF were real according to Eq.(3).

This is a great problem. Hence the author proposed another gravitational theory instead of the Einstein's gravitational theory.

GRAVITY GENERAED BY AN INTERACTION BETWEEN THE MASS AND THE ZPF FIELD

Jordan-Mbeutchou proposed a new model for Newtonian gravity by assuming space is filled with an ether (or aether) fluid [4]. He modeled gravity as an interaction between matter and ether fluid.

He assumed that matter can absorb ether fluid proportionally to its mass. Instead of an ether fluid, we assume that virtual particles (most of them are virtual photons) created from the ZPF field in a vacuum push matter, then the momentum flux density of virtual particles can be shown as

$$\nabla \cdot \vec{J} = -\rho_m / \tau_0, \qquad (6)$$

where $J = \rho_E / c$ (ρ_E : energy density of the ZPF energy), ρ_m is an equivalent mass density of the ZPF field and τ_0 is a retardation time.

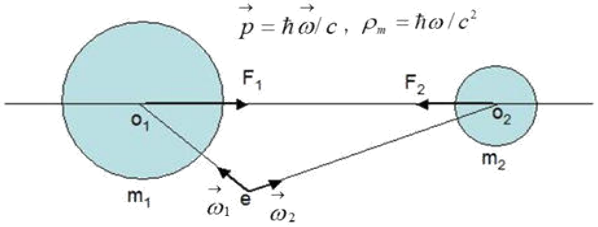

FIGURE 1: Two rest masses undergo the force generated the flow of ZPF energy

For the ZPF filed, we have the equation shown as [1]

$$\frac{d}{dt}\vec{P} = -\lim_{r_1 \to 0}\int_S (\vec{p}_1 + \vec{p}_2)[(\vec{p}_1 + \vec{p}_2)\cdot\vec{e}_1]/\rho_m \cdot dS, \quad (7)$$

If $\vec{\omega}$ is defined as $\vec{\omega} = c\vec{k}$ where $\vec{k}$ is a wave vector satisfying $k = \omega / c$, we can write $\vec{p} = \hbar\vec{\omega}/c$ and $\rho_m = \hbar\omega/c^2$, the amount of momentum created by the ZPF field can be shown as

$$\frac{d}{dt}\vec{P} = -\lim_{r_1 \to 0}\int_S \frac{\hbar}{c}(\vec{\omega}_1 + \vec{\omega}_2)\frac{c^2}{\hbar\omega}[(\frac{\hbar\vec{\omega}_1}{c} + \frac{\hbar\vec{\omega}_2}{c})\cdot\vec{e}_1]dS$$

$$= -\lim_{r_1 \to 0}\int_S \frac{\hbar\omega}{c^2}\left(\frac{c\vec{\omega}_1}{\omega} + \frac{c\vec{\omega}_2}{\omega}\right)\left[\left(\frac{c\vec{\omega}_1}{\omega} + \frac{c\vec{\omega}_2}{\omega}\right)\cdot\vec{e}_1\right]dS, \quad (8)$$

where $\vec{\omega}_1$ and $\vec{\omega}_2$ are vectors of the radial frequency of the ZPF field at the point e, as shown in Figure 1. According to the Jordan-Mbeutchou model, we have

$$(\vec{\omega}_1 + \vec{\omega}_2)\cdot\vec{e}_1 = \omega_1(r_1) + \omega_2(r_2)\frac{r_1 - r\cos\theta}{\sqrt{r_1^2 + r^2 + 2rr_1\cos\theta}}, \quad (9)$$

where θ is $\angle o_2 o_1 e$ and $o_1 e = r_1$, $o_2 e = r_2$ in Figure 1. When we let $c\vec{\omega}_1/\omega \to v_1$ and $c\vec{\omega}_2/\omega \to v_2$, then the force at the point o_1 in Fig,1 becomes the equation, according to the Jordan-Mbeutchou model [4].

$$F = \frac{d}{dt}P = \frac{\hbar\omega}{c^2}\frac{4}{3}\frac{4\pi}{(4\pi\rho_m)^2}\frac{m_1 m_2}{\tau_0^2}\frac{1}{r^2}\vec{e}_z$$

$$= \frac{1}{3\pi}\frac{c^2}{\hbar\omega\tau_0^2}\frac{m_1 m_2}{r^2}\vec{e}_z \quad , (10)$$

where a gravitational constant is given by

$$G = \frac{1}{3\pi}\frac{c^2}{\hbar\omega\tau_0^2}.$$

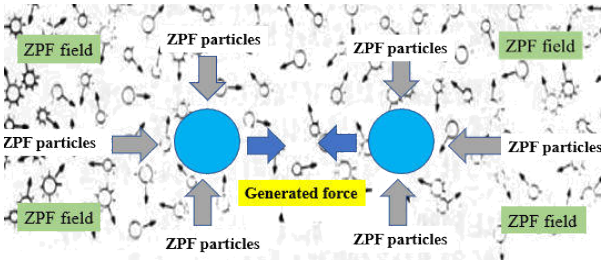

FIGURE 2: Generated force by the ZPF field

The Equation.(10) shows that the gravitational force can be generated by an interaction between matter and the ZPF field in a vacuum as shown in Fig.2. According to this equation, the Newtonian gravitational law can be obtained without the curvature of space. Hence it is considered that the gravity is an electromagnetic phenomenon induced by the ZPF field in the vacuum and it is not due to the curvature of space as claimed by Einstein. Thus it is considered that the gravity is an electromagnetic phenomenon induced by the ZPF field in the vacuum and it is not due to the curvature of space as claimed by Einstein. This equation predicts that the gravitational constant can be changed when the cut-off frequency of the ZPF field or the retardation time will be changed [5]. Thus the ZPF gravity theory predicts that the overall ZPF energy dose not gravitate and this means that the energy dose not have an equivalent gravitational mass as shown by $m = E/c^2$.

OTHER PROBLEM OF EINSEIN'S GRAVTATIONAL THEORY

In the theory of general relativity, the equivalence principle is the equivalence of gravitational and inertial mass, and Albert Einstein's observation that the gravitational "force" as experienced locally while standing on a massive body (such as the Earth) is the same as the pseudo-force experienced by an observer in a non-inertial (accelerated) frame of reference. In 1907, physicist Albert Einstein devised what we now call the "elevator" thought experiment, in which he dreamed up the idea of having an entire physics laboratory inside an ascending elevator. The result of Einstein's experimental elevator experiment was nothing less than the principles underlying the General Theory of Relativity.

However, one difficulty in the Einstein's gravitational theory is known as the equivalent paradox. A uniformly accelerated charge is recognized to radiate electromagnetic wave. According to the equivalence principle, which is the basis of Einstein's gravitational theory, the charged particle will radiate electromagnetic wave, but a charge suspended at rest in a uniform gravitational field dose not radiate electromagnetic wave.

According to general relativity, a uniformly accelerating system in free space should be equivalent to one at rest in a uniformly gravitational field. Thus, in this case the charged particle, the principle of equivalence seems to be violated. This problem has been discussed in some papers without adequate resolution [6-8]. Hence it is considered that the equivalence principle is not real, which is the basis of Einstein's gravity theory and Eq.(3) is not correct derived from the Einstein's gravity theory. But the ZPF gravity theory does not require the equivalence principle because the gravity is created as shown in Eq.(6).

According to the theory of the black hole proposed by the author [9], negative gravity due to tachyons created inside the ZPF vacuum in the star prevents all the star's matter to be completely crushed into a singularity.

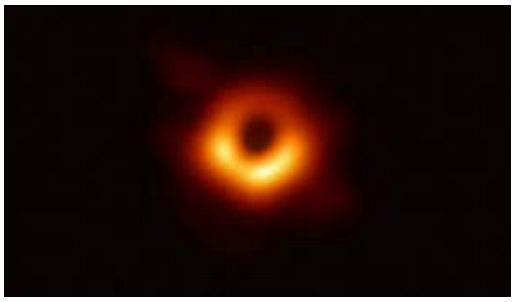

FIGURE 3: Dose the black hole really exist?

Thus there may be no black hole in the universe. From which, Einstein's gravitational theory is not correct and it is considered that the gravity must be reconsidered from the quantum electrodynamics theory.

CONCLUSION

According to the Einstein's gravitational theory, the ZPF energy in a vacuum will collapse the universe into singularity. Instead of Einstein's gravitational theory, the ZPF gravity theory is proposed and it shows that the energy field does not have an equivalent gravitational mass as claimed by the Einstein's gravitational theory. From this theory, it can be seen that there is no particle such as "graviton" predicted by Einstein's gravitational theory. Gravity is an electromagnetic phenomenon induced by the ZPF field in a vacuum.

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