Energy and SpaceTime

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Abstract

Referring to special theory of relativity led by Albert Einstein, we define the energy of graviton derived by the motion of mass. Based on this concept, we define the geometrical description of mass. Furthermore, we consider the wave function of energy by following these definitions.

1 Energy of graviton

In this section, we would define the energy of graviton g with the postulate that graviton is massless particle moves with the velocity c which is defined as the velocity of photon in the special relativity. Here we consider a collision that a graviton G collides a mass object M whose mass is m. After the collision, M starts to move to the opposite direction where graviton came, with the velocity v by absorbing graviton completely. We derive its energy by applying this collision to the energy-momentum equation, $E^2 = m^2 + p^2 = \gamma^2 m^2$, where E is energy, p is momentum, $\gamma = 1/\sqrt{1-v^2}$ and we set $c = 1$. The left-hand side represents the energy before the collision and the right-hand side is the one after the collision. With the conservation of energy, the collision of G and M could be expressed to

$$g + m = \gamma m. \tag{1}$$

Now we find the energy of graviton in this case is followed,

$$g = m(\gamma - 1). \tag{2}$$

We can find this collision breaks the conservation of momentum however if graviton has angular momentum, the conservation of angular momentum would also break. These law of conservation might consist with their breaks.

Now, we consider how this graviton model works on the earth as the gravitons are falling from the sky to the ground. By drawing 1 dimensional spatial axis x which is vertical to the ground, we can express the motion of accelerated object in 2 dimensional spacetime. Since the object falling freely by gravitation is in the inertial frame, the object fixed on the earth can be expressed as in the accelerating system. Simply, the accelerating system could be expressed as the coordinate whose time axis is bending to the ground. In the condition that the gravitons are falling to the ground, the object has to accelerate to the sky to be fixed on the ground.

We point out two observable facts about gravitation that any of objects accelerate with the same rate on the earth regardless any of mass and the object under another object accelerates with the same rate like a mouse under the table. To satisfy these facts we consider the graviton model again. Here we apply the hypothesis that the graviton could pass though the mass less than the specified mass. Now we set this amount as m_0. We fix a mass M' whose mass is $m' < m_0$ on the ground and later we fix another mass M" whose mass is $m'' < m'$. Now we consider graviton G collides to M' and M" and graviton pass through after collision. As both mass should move with the same velocity, these would be expressed as below,

$$g + m' = \gamma m' + g', \tag{3}$$

$$g + m'' = \gamma m'' + g'', \tag{4}$$

where $g > g'' > g'$. If we consider $m \gg m' \approx m''$, these would satisfy the latter fact. As the result, the energy of graviton is equivalent to $\gamma - 1$, therefore it could be expressed as followed when $m < m_0 = 1$,

$$g = \gamma - 1. \tag{5}$$

Additionally, the break of momentum conservation which might be applied to the break of angular momentum or any other properties is below,

$$p - g = 1 - \frac{\sqrt{1-v}}{\sqrt{1+v}}. \tag{6}$$

By this model, the energy of graviton would determine the acceleration rate of mass hence the Newtonian gravitational constant G_n would be no longer constant but variable includes negative value, $-a < G_n < a$, $a = const$. This implies the presence of mass would not create its own fixed gravitational field by itself thus the presence of energy would not create its own energy field. These would be applied to weak or strong field, as the single rule.

2 The origin of mass

Here we consider the geometrical description of mass along with the graviton could be described as bending time axis with a fixed spatial dimension when it merges into the motion of object. In 2 dimensional spacetime, the norm-squared of a vector V in the flat spacetime which contains no energy could be expressed below,

$$V^2 = -t^2 + x^2. \tag{7}$$

If we consider the spacetime contains energy at rest in the fixed space, we only can create it by contracting time axis. Hence it would expressed as followed,

$$V^2 = \eta t^2 + x^2, \tag{8}$$

where $-1 < \eta \leq 0$. If spacetime can contain energy not as mass but potential, this potential also would be included in this geometrical description.

Now we define the geometry of mass is the spacetime when $\eta = 0$, and potential would be described by $-1 < \eta < 0$. This means mass is the energy state of highest energy density or the extinction of time axis.

3 Wave function of Energy

Let us consider a point particle P which is a simple harmonic oscillator in 2 dimensional spacetime with conserved energy. By converting energy state, P carries only mass when its velocity $v = 0$. While $0 < v < 1$, it carries mass and kinetic energies and when $v = 1$, it carries only kinetic energy. Here we consider P is located $x = 0$ with $v = 1$ when $t = 0$. While t is $0 \leq t < T/4$, $T/2 \leq t < 3T/4$, kinetic energy converts to mass completely, where T is period. On the other hand, mass converts to kinetic energy completely while $T/4 \leq t < T/2$, $3T/4 \leq t < T$. The simple harmonic oscillation of P could be expressed to

$$x = \frac{T}{2\pi} \sin 2\pi \frac{t}{T}. \tag{9}$$

If we can say energy is equivalent to spacetime with the definition of mass, T is equivalent to P's energy E, therefore the relation between its frequency $f = 1/T$ and E with the constant value R is represented by the equation

$$E = \frac{R}{f}. \tag{10}$$

The relativistic combination of plural oscillations in multi dimensional spacetime would describe more.

4 No boundaries of time

Let us consider equation (9) again. This equation is time symmetry. Therefore, if positive and negative time could run back and forth in the range $T/4 \leq t \leq 3T/4$, we could not tell whether t would run in the closed range or opened by observing the displacement of x. However when the displacement of x is formed by the combination of plural oscillations and its time symmetry is broken, we are able to tell that the range of t is opened. If the arrow of time which we recognize is essentially formed by positive and negative time, we might be able to consider the arrow would fly in the eternal sky.

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