Original Research Article

Unification of the Gravity and the Electromagnetic Force

Abstract: In this work we find that around the hydrogen atom exists periodical variation of the electromagnetic wave. Based on the wave theory, the interaction between two hydrogen atoms is discussed, which leads to the conclusion that the Gravity is not special but just the different form of the electromagnetic force instead.

Keywords: Gravity, electromagnetic force, wave theory, unification theory, Grand theory, general relativity theory

I.Introduction:

Since I. Newton discovered the Gravity [1], the human beings have passed several centuries. Based on Newton's discovery, the behavior of our solar system has been elucidated quite well. However, about the origin of the Gravity, until now, the human beings made little progress. For example, I. Newton didn't give the explanation about how the Gravity was created. At that time, I. Newton only knew the Gravity force between two objects was proportional to the masses of objects and the proportional coefficient is $6.67x10^{-11}(Nm^2Kg^{-2})$. But I. Newton had never given any word about the mechanism how the Gravity was created in nature.

Later on, A. Einstein, based on his thought experiment, proposed the general relativity theory [2], in which the origin of the Gravity was described as the phenomenon resulting from the curved spacetime under the influence of the mass of object. Since then, scientists continuously make their prediction about our universe and propose a lot of new concepts and even new discovery in scientific field, especially in astronomy and cosmology fields, such as the Big Bang and Black Hole, etc.[3,4]. However, the general relativity theory is based on the assumption that our spacetime structure is the Rieman geometry, but in order for this assumption to be valid, we have to demonstrate or prove our spacetime is indeed the Rieman geometry, otherwise, the general relativity theory can't become a successful theory on the solid ground.

For the general relativity theory, another shortcoming is in that scientists spent a lot of time in trying to unifying the four basic forces in the nature, that is, the Gravity, the electromagnetic force, the weak and strong forces, but failed. The last three forces, the electromagnetic force, the weak and strong forces have been successfully unified but the Gravity, like a Ghost, still refuses to be unified [5,6].

Now scientists still work hard in trying to unify the last one, the Gravity, then, if succeeded, scientists will claim they find the general theory which governs our universe, called the Grand theory.

The scientist's ambition is brilliant but the reality is not so optimistic. Last century, the quantum mechanics has been setup, which is successful in explaining the phenomenon in micro world. Nobody doubts the quantum mechanics is a successful theory which governs the micro world. However, after carefully checking, scientists disappointedly found the general relativity theory and quantum mechanics

are not compatible each other [7]. This fact is really a big blow for those scientists who work hard in trying to unify the four forces in the nature and attempting to setup the Grand theory for our universe.

In this work, we try to solve this non compatibility problem between the general relativity theory and the quantum mechanics in different way and elucidate the gravity is not special but just the different form of the electromagnetic force. In order to keep our discussion as simple as possible, we will take the hydrogen atom as an example to start our discussion.

II. Theory

The hydrogen atom can be simply illustrated in Fig. 1.

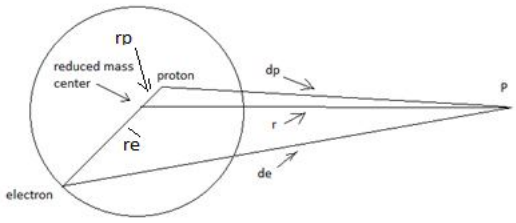


Fig.1 Illustration of Hydrogen Atom

The mass center located at the center of the circle (we show the movement of proton and electron around the mass center on two dimensions for convenience). Based on the trigonometry, the electromagnetic field strength at the position P is the summation of the electromagnetic field strengths of proton and electron at the position P, which will be,

$$d_p^2 = r_p^2 + r^2 - 2r_p r cos\theta_p;\ d_e^2 = r_e^2 + r^2 - 2r_e r cos\theta_e$$

$$E_{total} = E_e + E_p$$

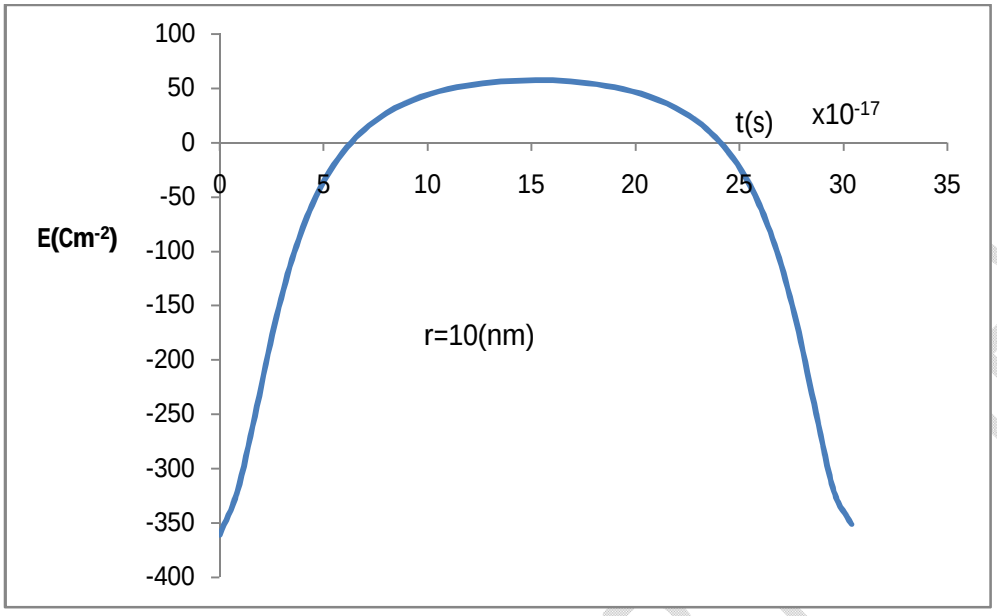
$$= -\frac{e}{r_e^2+r^2-2r_e r cos\theta_e} + \frac{e}{r_p^2+r^2-2r_p r cos\theta_p} \qquad (1)$$

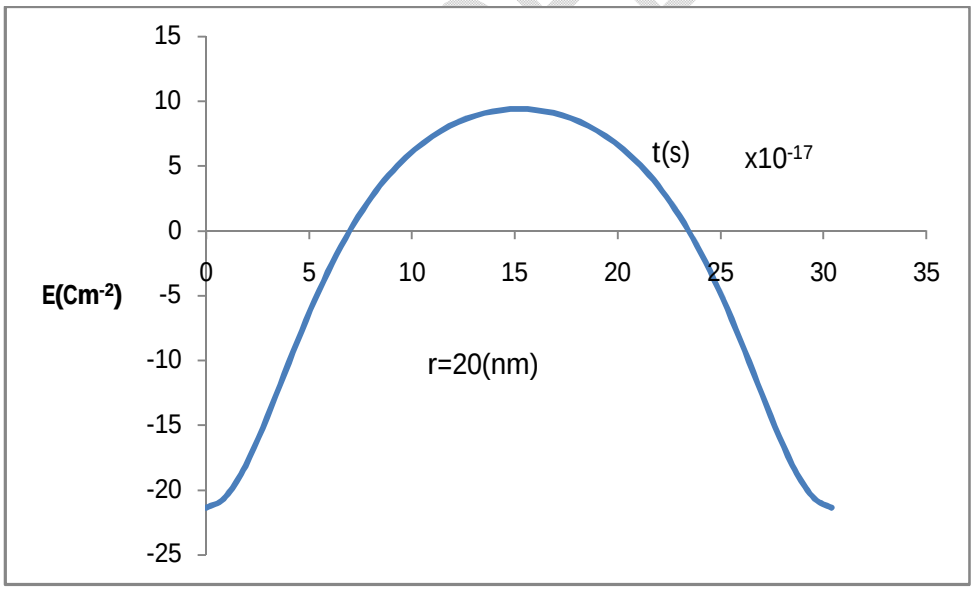
From these expressions above, we know that at the position P, the electromagnetic field strength is not zero but has certain nonzero value. Furthermore, based on the expression of E_{total} at the position P, we find the electromagnetic field strength at the position P is not a constant and the sign of the electromagnetic field strength at the position P is not a constant either. For example, at the position P, the maximum positive electromagnetic field strength is at $\theta_p = 0, \theta_e = \pi$, which will be,

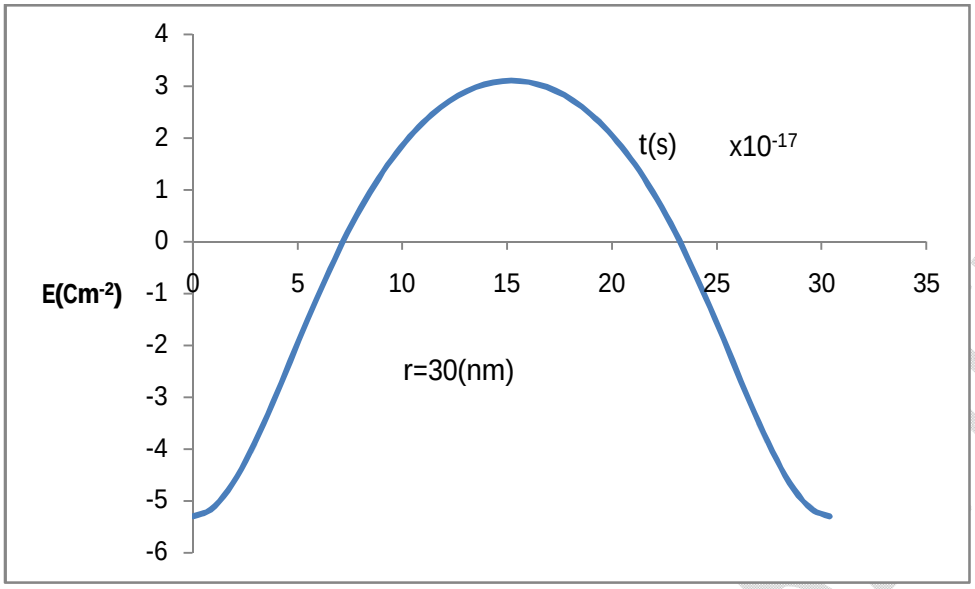
$$E_{total}^{+} = -\frac{e}{(r+r_e)^2} + \frac{e}{(r-r_p)^2} \qquad (2)$$

While the maximum negative electromagnetic field strength at the position P is at $\theta_p = \pi, \theta_e = 0$, which will be,

$$E_{total}^{-} = -\frac{e}{(r-r_e)^2} + \frac{e}{(r+r_p)^2} \quad (3)$$







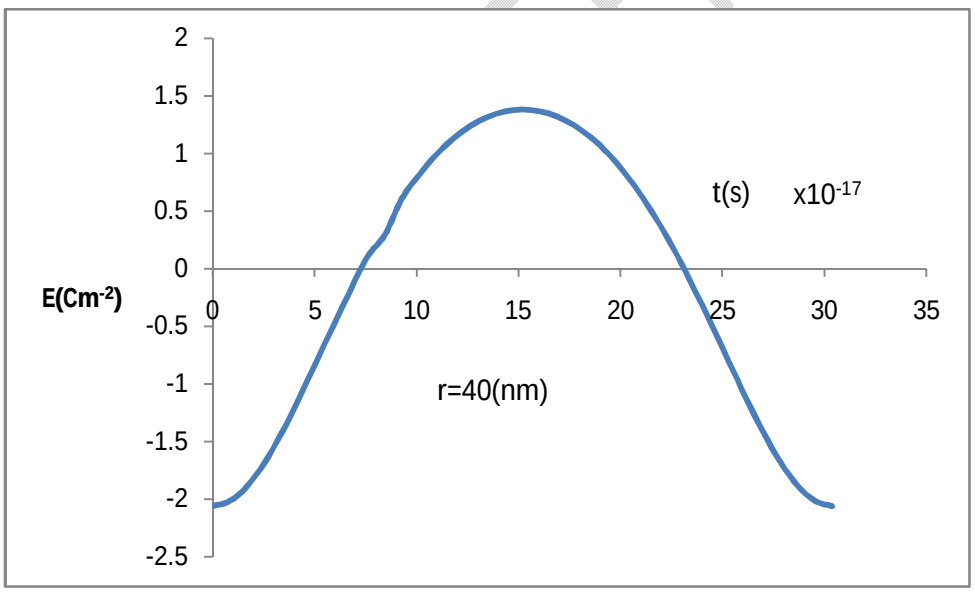


Fig.2 The variation of the electromagnetic field strength at the Position P

(here we only show the variation of one period of electromagnetic wave)

The electromagnetic field strength at the position P will change back and forth between the positive E^{+}_{total} and the negative E^{-}_{total}. With r increasing, the strength of $E^{+}_{total}$and E^{-}_{total} approaches each other and finally it will be the same. This distance is determined experimentally about 8.74x10^{-11}m [8]. Then, the variation of E_{total} beyond this distance will be like an electromagnetic wave created by the radiation source (Fig.2).

III. Discussion

Conventionally, the situation described above is explained as the result of the electric dipole (even though we use the simple Bohr model in our consideration) [9]. In fact, the result (Fig.2) here still reveals the different physical character from that of the electric dipole.

First, the variation of the electromagnetic field strength is the distance-dependent, the closer to the hydrogen atom, the more asymmetric property of the electromagnetic field strength becomes and only beyond certain distance from the hydrogen atom, the symmetry of the electromagnetic field strength can be approached. For the pure electric dipole, no this kind of tendency will appear.

Second, as we pointed out above, beyond the certain distance (8.74x10^{-11}m [8]) from the hydrogen atom, the electromagnetic field strength varies as the wave which can be described by the sine or cosine function but the pure electric dipole doesn't show this kind of behavior.

Third, the variation of the electromagnetic field strength will radiate energy and correspondingly, the electromagnetic wave propagates [9] but here the variation of the electromagnetic field doesn't radiate energy and no electromagnetic wave propagation occurs. The reason causes the difference between the hydrogen atom and the conventional electric dipole is in that for the conventional electric dipole, there exists radial dynamic momentum, therefore, this radial dynamic momentum will cause the radiation and the electromagnetic wave propagation, while for the hydrogen atom, there only exists rotational dynamic momentum, no radial dynamic momentum, therefore, no radiation and the electromagnetic wave propagation occurs (Fig.2 and Fi.g3), and we can call this kind of electromagnetic wave created by the hydrogen atom as stationary wave or standing wave [10,11,12].

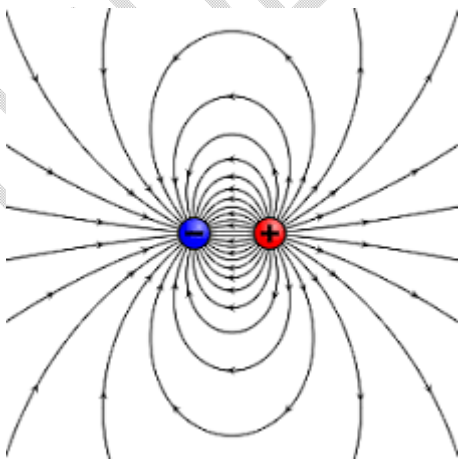


Fig. 3 Illustration of Electric dipole

Fourth, the electric dipole always has its definitive orientation but for the hydrogen atom, it doesn't have the definitive orientation.

Fifth, the radiation from the electromagnetic wave created by the electric dipole should be quantized, that is, discontinuous wave [13] but the electromagnetic wave around the hydrogen atom is continuous one instead (Fig.2).

Based on these characters which are different from the conventional electric dipole, we can explore the physical meaning behind these facts.

1. How to interact each other when two hydrogen atoms approach each other?

As discussed above, when the space point is beyond the certain distance from the hydrogen atom, the variation of the electromagnetic field strength at the space point can be described as

$$E = E_0(r)\cos(\omega t + \varphi_0) \quad (4)$$

$$B = B_0(r)\cos(\omega t + \varphi_0) \quad (5)$$

Where r is the distance from the hydrogen atom (the reduced mass center), ω is the frequency of the variation of the electromagnetic field strength around the hydrogen atom. φ_0 is the phase, E is the strength of electric field and B is the strength of magnetic field.

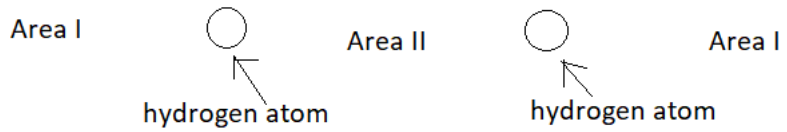


Fig.4 Illustration of Two Hydrogen Atoms System

Based on the wave theory [10,11,12], when two direction waves meet each other, the two waves will become destructive or constructive waves at the common area (Fig.4), which can be expressed as

For constructive,

$$E_{total} = E_{01}(r_1)\cos(\omega_1 t + \varphi_{01}) + E_{02}(r_2)\cos(\omega_2 t + \varphi_{02}) \quad (6)$$

$$B_{total} = B_{01}(r_1)\cos(\omega_1 t + \varphi_{01}) + B_{02}(r_2)\cos(\omega_2 t + \varphi_{02}) \quad (7)$$

For destructive,

$$E_{total} = E_{01}(r_1)\cos(\omega_1 t + \varphi_{01}) - E_{02}(r_2)\cos(\omega_2 t + \varphi_{02}) \quad (8)$$

$$B_{total} = B_{01}(r_1)\cos(\omega_1 t + \varphi_{01}) - B_{02}(r_2)\cos(\omega_2 t + \varphi_{02}) \qquad (9)$$

From Fig.4, it is clear that if two waves become constructive, it will push two hydrogen atoms away from each other because the wave strength at the area II will be stronger than that at the area I. This situation corresponds to the high energy state for the two hydrogen atoms system. Whereas if the two waves become destructive, the situation will be reversed because at the area II, the strength of the wave of electromagnetic field will be weaker than that at the area I, therefore, the two hydrogen atoms will be pushed closer, which looks like there exists attractive force between two hydrogen atoms. This situation corresponds to the low energy state for the two hydrogen atoms system.

Due to the fact that the destructive state is the low energy state and all system will automatically prefers the low energy state, therefore, the net result is the two hydrogen atoms will exhibit the tendency to approach each other, just like there exists attractive force between the two hydrogen atoms.

2. The Effect of the COSMIC Background Radiation (CMB)

In our previous work [14], we pointed out that our spacetime is the electromagnetic spacetime and all matters in our universe are made from the compressed spacetime, therefore, an hydrogen atom in our spacetime looks like a piece of ice floating in water. Around the hydrogen atom distributed the electromagnetic wave. If the strength or frequency of the electromagnetic wave from the hydrogen atom is higher than that of its electromagnetic microwave background, the energy of the hydrogen atom will be disposed to the spacetime around the hydrogen atom in the form of the electromagnetic wave radiation. The equilibration will be reached if the electromagnetic wave distributed around the hydrogen atom is balanced by the electromagnetic microwave distributed at the hydrogen atom background. Whether the hydrogen atom can be kept stable or not depends on three factors: (1) the frequency of the electromagnetic wave from the hydrogen atom is compatible with that of its electromagnetic microwave background (CMB) [15]. Here we can coarsely calculate the frequency of the electromagnetic wave from the hydrogen atom which is ω_h = 3.2901064 × $10^{15}(s^{-1})$, while the frequency of the CMB (here we take 2.72 Kelvin in our calculation) is ω_B = 3.5609498 × $10^{14}(s^{-1})$ [16], a little less than that of the hydrogen atom. This small difference in the frequency between the hydrogen atom and its background can be compensated by the movement of the hydrogen atom [17] and the temperature, 2.72 Kelvin, is just a mean value in our calculation, therefore, we can reasonably assume that the frequency of the electromagnetic wave from the hydrogen atom is the same as that of the background electromagnetic microwave (CMB). (2) As we pointed out above, the electromagnetic wave created by the hydrogen atom is a standing wave, not propagation wave, that is, no radial momentum, only rotational momentum exists in the electromagnetic wave created by the hydrogen atom, this is the reason why the standing electromagnetic wave will not dispose the energy by the radiation of electromagnetic wave to its surroundings. (3) As we pointed out in our previous work [12], the radiation of the electromagnetic wave propagates discontinuously, not continuously like that in Fig.2.

In quantum mechanics [18], it is well known that, the electron in hydrogen atom can be excited to higher energy level but the electron can't stay at the higher energy level longer and will automatically

return to the ground state. Conventionally, this phenomenon is explained as spontaneous emission or self excitation (de-excitation). Here we give our alternative explanation for this phenomenon, that is, when the electron is excited to the higher energy level, due to the interaction between the excited state and its background (as we analyze above, the excited electron at the higher energy level and its background (CMB) can't keep harmony frequency of the electromagnetic wave), the excited electron can't keep stable and will return to the ground state, just like a person standing on the ladder, if the ground always shakes or vibrates, the person can't stay on the ladder long time, he or she will fall down to the ground sooner or later. In this world, nothing can spontaneously happen or self excited/de-excited without reason. The phenomenon in the nature has no mysteries, all mysteries are due to the human being doesn't understand it, if we understand the background principle governing the mysterious phenomenon in the nature, then, the mysteries will disappear.

3. The Unification of the Gravity and the electromagnetic force

At the Newton time, the human beings still have no idea about the atom, electron and molecule, not mention the quantum mechanics. I. Newton only can observe the collective behavior of the matter around him in the nature. Therefore, I. Newton can't explain the Gravity at the atomic level. Based on his observation about the behavior of two objects in the nature (typical example is that Newton observed the apple falling down to the ground from the apple tree), which leads him to propose the Gravity.

Here we will try to explore the origin of the Gravity based on our result above.

From the expression of E_{total} at the position P, the maximum positive electric field strength is at $\theta_p = 0, \theta_e = \pi$, which will be

$$E^{+}_{total} = -\frac{e}{(r+r_e)^2} + \frac{e}{(r-r_p)^2} \qquad (2)$$

The maximum negative electric field strength at the position P is at $\theta_p = \pi, \theta_e = 0$, which will be

$$E^{-}_{total} = -\frac{e}{(r-r_e)^2} + \frac{e}{(r+r_p)^2} \qquad (3)$$

The electric field strength at the position P will change back and forth between the positive E_{total} and the negative E_{total} with time (the variation of electric field will create the corresponding magnetic field, for simplicity, we don't discuss this corresponding magnetic field here). With r increasing (the distance from the position P to the reduced mass center of the hydrogen atom), the strengths of the E^{+}_{total} and E^{-}_{total} approaches each other and finally will become the same. This distance is determined about $8.7372603 \times 10^{-11}$m experimentally [8]. Then, the variation of E_{total} beyond this distance will be like a electromagnetic wave created by a point electromagnetic wave source. This point of electromagnetic wave source is different from the conventional point charge in that:

a. For the conventional point charge, it can't create the periodical variation of the electromagnetic field from the positive to negative, which is different from that of the hydrogen atom. This character of the electromagnetic wave around the hydrogen atom makes two hydrogen atoms approach each other

and always show the attractive, not repulsive at the ground state (the system only shows repulsive character at the constructive case). This attractive phenomenon between two objects in the nature discovered by I. Newton, but at Newton time, the atomic structure and quantum mechanics still not be discovered and established yet. Therefore, it is impossible for I. Newton to elucidate the origin of the Gravity at the quantum mechanics level at that time. Consequently, I. Newton just uses the Gravity to describe the phenomenon observed in the nature. We guess Newton may try to think the origin of the Gravity or may not. Anyway Newton stopped exploring the origin of the Gravity. The formulae of the Gravity setup by I. Newton describe the movement of planets in our solar system quite well. This is very important discovery in scientific history indeed.

b. We all know the basic unit of electricity is e ($1.6021892 \times 10^{-19}$C) but here we have to point out, in this case, the hydrogen atom behaviors like 0.0659802239e. That's why normally we take the hydrogen atom as electric neutral point.

c. the point charge always has sign, that is , positive or negative, but 0.0659802239e is no definitive sign, when a positive point charge approaches, it will behavior like a negative point charge, if the negative point charge approaches, it will behavior like positive point charge. Even two neutral hydrogen atoms approach each other, one hydrogen atom will behavior like the positive point charge, other one will behavior like negative point charge.

Due to the three points mentioned above, I. Newton observed the attraction between two objects and since the lack of knowledge at the quantum level, I. Newton uses masses of objects to describe the attractive force. If e is replaced by m in the electromagnetic force equation by mistake (here the mass should be the reduced mass of the hydrogen atom), then the Gravity constant will be 6.67×10^{-11}. The electric charge, 0.0659802239e can be reasonably ignored at Newton time, this is the only possible reason for I. Newton taking account of the Gravity as a phenomenon happened between two neutral objects in the nature.

A.Einstein tries to give the origin of the Gravity by setting up the general relativity theory. In the general relativity theory, the spacetime around the mass of object will be curved, then, the Gravity is the consequence of the curved spacetime under the influence of the mass of object. Conventionally, this situation is stated as the mass of object tells the spacetime how to curve, whereas the curved spacetime tells the object how to move.

As we pointed out in our previous work [14], for Einstein's explanation of the Gravity, there exist at least two shortcomings:

(1) We can take our moon-earth system as an example here, the moon moves following the curved spacetime around the earth. If this is true, then, all stuff falling or entering the moon-earth system should moves as the moon around the earth but it is not. Anything falling in the moon-earth system doesn't move in the same way as the moon. Then, the different stuffs should have different curved spacetime in the moon-earth system. However, the spacetime in the moon-earth system should be unique spacetime, otherwise, we have to suppose the existence of different spacetime in the moon-earth system. This will be ridiculous situation indeed.

(2) It is well known that the quantum mechanics and the general relativity theory are not compatible each other [7].

Based on our discovery here, for two hydrogen atoms approaching each other, there exist two energy states: one is the destructive state which is lower energy state and other one is the constructive state which is higher energy state. The destructive state will form two different strengths of electromagnetic wave zones (Fig.4). The electromagnetic wave strength in zone 1 will be higher than that in zone 2. The difference in the strength of electromagnetic wave between zone 1 and zone 2 will create attractive force between hydrogen atoms. In this case, the CMB background will also make certain contribution to this creation of the attractive force between two hydrogen atoms. These two factors collectively formed the Gravity observed between objects in nature.

For the electromagnetic wave constructive state, the energy of this state is higher than that of destructive state. The electromagnetic waves from two hydrogen atoms will resonance and consequently, push two hydrogen atoms away from each other. If the system only includes two hydrogen atoms, the repulsing phenomenon between two hydrogen will not be observed because all systems obey the principle of the minimizing the energy of system. However, if the system suffered the influence of electromagnetic wave from the outside system, the situation will be changed. For example, if the electromagnetic wave from outside source makes the strength of the electromagnetic wave in zone 2 higher than that in zone1 (the strength of electromagnetic wave obeys the addition principle), then we will see the two hydrogen atoms will be pushed away from each other, it will look like there exists repulsing force between two hydrogen atoms instead of attracting force.

Astronomically, we do observe two Galaxies fly away each other [19,20] but conventionally, this situation is explained by the explosion theory of our universe. Some scientists explain this situation as the effect of dark energy and dark matter in our universe [3,4]. Here we give different explanation based on our theory propose above.

At Newton time, he can't analyse the origin of the Gravity in our way here because I. Newton has no knowledge regarding quantum mechanics and the structure of atom. Therefore, he stopped at the proposition of the Gravity formulae and just focused on the application of the Gravity formulae setup by him. In a word, due to the lack of knowledge about the micro world at Newton time, I. Newton incorrectly think the attractive force results from the masses instead of the charges of two objects. Here we corrected this historically mistake made by the scientific Giants in history of science.

IV. Conclusion

In this work we demonstrate that around the hydrogen atom a periodical variation of electromagnetic wave exists. When two hydrogen atoms approach each other, the electromagnetic waves from two hydrogen atoms can form destructive or constructive wave at the common area. For the destructive case, the two hydrogen atoms will be pushed closer, like there is attractive force between the two hydrogen atoms, whereas for the constructive case, the two hydrogen atoms will be pushed away from each other, like there is a repulsive force between two hydrogen atoms. All these

facts lead to the conclusion that the Gravity is not special but just the different form of the electromagnetic force instead.

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