A Classical Unification of Classical Mechanics with Quantum Mechanics: Why Photon Should Have an Intrinsic Mass

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Abstract: ***A very recently discovered new particle in the Large Hadron Collider at CERN, Geneva, with a mass of 125 GeV/C*** ^{2} ***is actually a Higgs particle of some type. The Higgs field or natural Higgs Particle gives rest masses to elementary particles that would otherwise travel at a speed of light (*** C ***). But it is only the energy of the particles which bends space-time and resultantly causes gravity. Even photons with no rest mass (assumed) will bend the space-time. All that Higgs does is forces these formerly mass-less particles to slow down significantly in comparison with the speed of light (*** C ***) to sub-light speeds or resist their acceleration. But Higgs does not give masses to all particles like photons, gluons gravitons, that is the reason why Higgs field is not called an Universal force while gravity is always a universal force (the term universal is not referring to the Universe but to the notion universality – of complete generality). In this paper, I will show how classical mechanics can be unified to the quantum mechanics with the help of force, energy, mass, gravity, and momentum. I will also show that why photons should have an intrinsic mass.***

Keywords: Large Hadron Collider, Higgs Particle, Speed of Light (C), Space-Time, Classical Mechanics and Quantum Mechanics

1. Introduction and the Theories

The first tutorial about gravity in school was basically Newton's laws [1, 2]. The force of gravity between two objects separated by a distance d with mass of one body M_1 and the mass of the other body M_2, has a strength proportional to the product M_1M_2 [3, 4]. If the force of gravity is F , then,

$$F \propto M_1M_2$$

$$F \propto \frac{1}{d^2}$$

$$F = G\frac{M_1M_2}{d^2}$$

G is the Gravitational Constant.

But it was true before Einstein. After Einstein [5, 6], it is turned out that Newton's Law need to be revised [7, 8]. The Einsteinian statement of the Law of gravity is two objects that are slow moving (their speed relative to one another is much less than C [9, 10], and have energy E_1 and E_2 , the gravitational force between the two objects has a strength proportional to the product E_1E_2 [11, 12]. Are those two statements consistent [13, 14]? They are consistent because Einstein established a theory that relates energy E , momentum ρ and mass M (sometime called rest mass or simply mass by particle physicists) is [15, 16] –

$$E^2 = (\rho C)^2 + (MC^2)^2$$

For slow moving objects, $\rho = Mv$ (where v is the objects velocity) and $\rho C = MvC$ is much smaller than MC^2 [17, 18]. And therefore,

$$E^2 \approx (MC^2)^2$$

$$E = MC^2 \quad \text{----------------- (1)}$$

This is only valid for slow moving objects.

2. The Unification of Classical Mechanics With Quantum Mechanics

According to the laws of Newton [19, 20], if the force of gravity between two objects is F , then,

$$F \propto M_1M_2$$

$$F \propto \frac{1}{d^2}$$

$$F = G\frac{M_1M_2}{d^2}$$

If both objects have the same mass $M_1 = M_2 = M$

$$F = G\frac{M^2}{d^2}$$

G is the Gravitational Constant.

If g is the gravitational acceleration due to force of gravity F , then,

$$g = G\frac{M}{d^2}$$

g is also called Gravitational Field Intensity.

From the Newton's second law of motion, if a body with mass M is under a force F will experience acceleration a [21, 22].

$$F = Ma$$

If a body with mass M is under a gravitational force F will experience a gravitational acceleration g [23, 24]

$$F = Mg \qquad \text{----------- (2)}$$

Comparing equation (1) and (2), we get,

$$\frac{E}{F} = \frac{MC^2}{Mg}$$

$$\frac{E}{F} = \frac{C^2}{g} \qquad \text{--------------- (3)}$$

If a mass M travels a distance d against the force F, the energy gained by the mass is E with the following relationship,

$$E = Fd \qquad \text{------------ (4)}$$

Putting equation (4) in equation (3), we get,

$$\frac{Fd}{F} = \frac{C^2}{g}$$

$$d = \frac{C^2}{g} \qquad \text{------------ (5)}$$

$$d = \frac{K}{g} \quad (K = C^2)$$

Therefore, gravitational field intensity is inversely proportional to the distance between both bodies. If $d \to \infty$, then $g \to 0$. It proves that, for a very large distance, gravitational intensity approaches to zero. Thus, almost all the gravitational intensity is within the galaxy for astronomical bodies, and hardly any significant effect outside the galaxy.

$$d \propto \frac{1}{g}$$

Distance and gravitational field intensity have linear relationship and inversely proportional to each other.

$$dg = C^2 = K$$

The product of distance between two bodies and gravitational intensity is a Universal constant.

$$F = G\frac{M_1M_2}{d^2}$$

If mass M_1 possess energy E_1 and mass M_2 possess energy E_2, then from equation (1) and (5), we get,

$$F = G\frac{(E_1/C^2)(E_2/C^2)}{(C^2/g)^2}$$

$$F = G\frac{E_1E_2g^2}{C^8}$$

$$F \propto g^2$$

For particular two bodies (slow moving), M_1 (or E_1) and M_2 (or E_2) are constants. Then, gravitational force and gravitational field intensity have non linear relationship but directly proportional to each other.

Putting equation (5), we get,

$$F \propto \frac{1}{d^2}$$

But, $E = Fd$, then,

$$\frac{E}{d} \propto \frac{1}{d^2}$$

$$E \propto \frac{1}{d}$$

The effect of energy on the other object and the distance between two objects having both masses M have linear relationship but inversely proportional to each other.

$$\text{But, } F = G\frac{M_1M_2}{d^2}$$

$$\frac{E}{d} = G\frac{M_1M_2}{d^2}$$

$$E = G\frac{M_1M_2}{d}$$

$$\text{But, } E = MC^2$$

Then, If $M_1 = M_2 = M$,

$$MC^2 = G\frac{M^2}{d}$$

$$C^2 = G\frac{M}{d}$$

$$\frac{M}{d} \propto C^2$$

The ratio of mass of a body with separation between two bodies is always a constant. If mass increases, the separation will increase proportionally to maintain stability of both the bodies. Otherwise, it will be an unstable system.

$$\text{But, } d = \frac{C^2}{g}$$

$$C^2 = G\frac{Mg}{C^2}$$

$$Mg = G^{-1}C^4$$

$$\text{But, } F = Mg$$

$$Thus, F = G^{-1}C^4$$

The product of mass of a body with gravitational field intensity (gravitational force between two bodies) is always a constant for a stable system. Otherwise, the system will be unstable.

$$d = \frac{C^2}{g}$$

$$or, g = \frac{C^2}{d}$$

$$But, g = G\frac{M}{d^2}$$

$$or, d^2 = G\frac{M}{g}$$

$$or, d^2 = G\frac{M}{(C^2/d)}$$

$$or, d = G\frac{M}{C^2}$$

The distance between two objects having both fixed masses M is always a constant to be a stable system. Otherwise, the system will be unstable.

3. Why Photon Should Have An Intrinsic Mass

According to Einstein [25, 26],

$$E^2 = (\rho C)^2 + (MC^2)^2$$

For fast moving objects (photon), $\rho = Mv$ (where v is the objects velocity) and $\rho C = MvC = MC^2$, because $v = C$ and therefore,

$$E^2 = 2(MC^2)^2$$

$$E = \sqrt{2}MC^2$$

$$\frac{E}{M} = \sqrt{2}C^2$$

We know that photon have finite energy E. For finite energy E, mass of photon cannot go to zero.

Thus, $M \neq 0$ for photon. Therefore photons have an intrinsic mass too.

4. Conclusion

In this paper, I unified Einstein's laws of gravity with Newton's laws of gravity. In other words, I unified a classical unification of classical mechanics with quantum mechanics. Also I showed that gravitational field intensity is inversely proportional to the distance between both bodies. If $d \rightarrow \infty$, then $g \rightarrow 0$. It proves that, for a very large distance, gravitational intensity approaches to zero. Thus, almost all the gravitational intensity is within the galaxy for astronomical bodies, and hardly any significant effect outside the galaxy. Distance and gravitational field intensity have linear relationship and inversely proportional to each other. Gravitational force and gravitational field intensity have non linear relationship but directly proportional to each other. Energy and the distance between two objects having both masses M have linear relationship but inversely proportional to each other. For a stable system, the ratio of mass of a body with separation between two bodies is always a constant. If mass increases, the separation will increase proportionally to maintain stability of both the bodies. Otherwise, it will be an unstable system. The distance between two objects having both fixed masses M is always a constant to be a stable system. Otherwise, the system will be unstable. Lastly, I showed that photons have an intrinsic mass too.

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