

DOI: <https://doi.org/10.24297/jap.v21i.9414>**Theory of the Unified Gravity: Sayed's Quantum Gravity Force (SQGF) as a Function in Wavelength and Planck Length with Inevitability of Light Speed Violation**

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Abstract

Nothing by chance, everything was created by Allah (God). Quantum gravity (QG) is a hundred year unsolved puzzle and nagging mystery. This article introduces an innovative theory to describe quantum gravity by merging Newtonian, general relativity and quantum mechanics concepts. A unified formula and equations for quantifying and defining the quantum gravity was derived. It is called Sayed's quantum gravity force (SQGF). It can be concluded that the gravity is a force inversely proportional to the square of the gravity quanta wavelength and distance; it is not only due to warping and curvature of the space-time fabric. The derived equation indicates that the gravity is also quantized. The Sayed's gravitational constant ($\hbar^2 s^M$) was given. The SQGF formula was validated and verified by check its units and calculations of the wavelengths in the micro and macroscopic scale. For the micro gravity force of $1\mu\text{N}$ (1 micro Newton), the wavelength was calculated. It was found to be in the measurable range of the electromagnetic spectrum. The quanta gravity wavelength of values 5.6026×10^{-9} m and 2.83457×10^{-13} m were found for Planck scale and electron-proton of H-atom respectively. A proposed approach to measure the relative gravity wavelengths is given. It can revolutionary be concluded that the speed of light is a variable. The violation of light speed is a must for the instantaneous nature of the gravity quanta and the entanglement phenomena.

Keywords: Sayed's theory of Quantum Gravity / Innovative derived formula (SQGF)/Light speed violation

I. Introduction

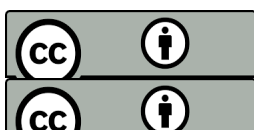
The quantum gravity concept and puzzle was raised - 100 year ago. There is no any theory explains this problem till now. Different explanations for gravity were given by Newton, Einstein and quantum mechanics (1, 2). The author of this article published different papers dealt with innovative approaches in similar debatable issues in physics (2-5). Understanding the quantum nature of space-time and gravity remains one of the most ambitious goals of theoretical physics. It promises to provide key new insights into fundamental particle theory, astrophysics, cosmology and the foundations of physics (6).

This article introduces a new theory to derive an innovative unified formula clarifying and explaining the bogging concept of quantum gravity (QG) by merging the different ancient known gravity concepts.

II. Literature and Survey

The wide and deep variation in describing of gravity can easily be found as vision of the classic mechanics of Newton, general relativity of Einstein and quantum mechanics. This part of the article represents the related subject of gravity. The survey of the topics related to gravity concept is given as follows:

- In an article published in the journal *Leonardo*, the researchers draw upon a fresh look at one of da Vinci's notebooks to show that the famed polymath had devised experiments to demonstrate that gravity is a form of acceleration—and that he further modeled the gravitational constant to around 97 percent accuracy (7)
- Microgravity, a measure of the degree to which an object in space is subjected to acceleration. In general parlance the term is used synonymously with zero gravity and weightlessness, but the prefix micro indicates accelerations equivalent to one-millionth (10^{-6}) of the force of gravity at Earth's surface (8).
- Gravity is, by far, the weakest of the four fundamental interactions, approximately 10^{38} times weaker than the strong interaction, 10^{36} times weaker than the electromagnetic force and 10^{29} times weaker than the weak interaction. As a result, it has no significant influence at the level of subatomic particles (microscopic scale). However, gravity is the most significant interaction between objects at the macroscopic scale, and it determines the motion of planets, stars, galaxies, and even light (9).
- The short answer for why gravity is unique is that it is the theory of a massless, spin-2 field. To contrast with the other forces, the strong, weak and electromagnetic forces are all theories of spin-1 particles (10).



- Another difference between Newton and Einstein is that Einstein's theory recognizes that the source of gravity is not mass, as Newton believed, but energy, one form of which is mass. This means that all forms of energy have gravity: sound energy, heat energy and so on (11).

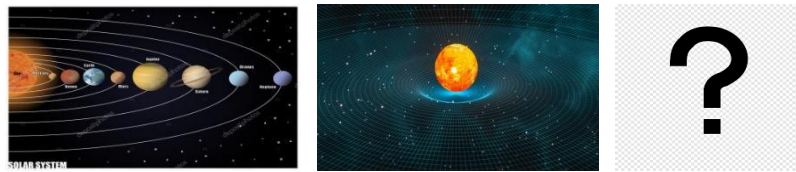


Fig. 1: Gravity of Newton & Curvature of the spacetime fabric (12) & Quantum gravity (QG)

- There are several factors that make it hard to measure gravity: (1). The forces are small. Typically, the gravitational force produced by the mass arrangement is well below $1\ \mu\text{N}$. (2) The gravitational background fields generated by the earth, structures and objects in the laboratory, and humans cannot be shielded.(13)
- The history of physics has two great revolutionary theories, such as relativity and quantum physics. However, the new discoveries of the particle physics do not fit with the principles of both theories (14)
- The search for a consistent and empirically established quantum theory of gravity is among the biggest open problems of fundamental physics. The obstacles are of formal and of conceptual nature (15).
- Gravity was the first fundamental force that humanity recognized, yet it remains the least understood. Physicists can predict the influence of gravity on stars and planets with exquisite accuracy, but no one knows how the force interacts with minute particles, or quanta (16)
- Quantum Gravity, at present, there is no such a theory which is universally accepted and confirmed by experience. Therefore the term "Quantum Gravity" indicates more an open problem than a specific theory (17).
- At present, we do not know whether gravity is an inherently quantum force or not, as no experiment or observation has been able to make such a critical measurement (18).
- A good theory of quantum gravity does not yet exist, but one will be needed to understand how all four forces may be unified. If we are successful, the theory of quantum gravity will encompass all others, from classical physics to relativity to quantum mechanics—truly a Theory of Everything (TOE) (19).
- Quantum mechanics suggests everything is made of quanta, or packets of energy, that can behave like both a particle and a wave for instance, quanta of light are called photons. Detecting gravitons, the hypothetical quanta of gravity, would prove gravity is quantum. The problem is that gravity is extraordinarily weak (20)
- It is clear that the graviton should be a spin-2 boson in order to be consistent with GR and quantum field theory (QFT) (21).
- The loop quantum theorists begin with the great (gravity) and turn to the small (quantum theory), while the string theorists start with the small (quantum theory) and want to achieve the great (gravity) (22).
- On 11 February 2016, the Advanced LIGO team announced that they had directly detected gravitational waves from a pair of black holes merging (23). The wavelength of the gravitational wave would correspond to a frequency of 0.5 Hz, and a wavelength of $\sim 600\ 000\ \text{km}$.

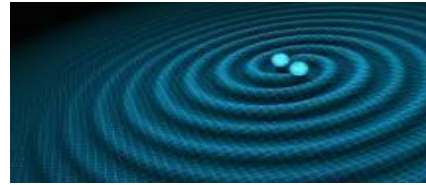
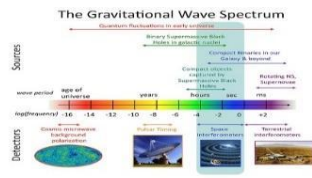


Fig. 2: The gravitational wave spectrum (23). Fig. 3: Gravity waves of merging Neutron stars /BHs (20)

III. Derivation of Sayed Quantum gravity Force (SQGF) formula:

The Newton definition of gravity as a force (F) between two masses (m₁ and m₂) can be given as (2, 24):

$$F = G m_1 m_2 / r^2 \tag{1}$$

Where, G is the Newton gravitational constant (6.67 × 10⁻¹¹ N m² kg⁻²) denotes strength of gravitation and r is the distance between centers of these masses

The equation number 1 can be rewritten as follow:

$$G = F r^2 / m_1 m_2 \tag{2}$$

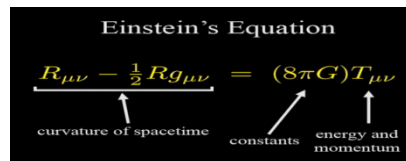
The Einstein field equations (theory of general relativity) that define the gravity as deformation and curvature of the space time fabric is given by his expression (2, 25).

$$G_{\mu\nu} + g_{\mu\nu} \Lambda = (8\pi G/c^4) T_{\mu\nu} \tag{3}$$

Where, the value (8πG/c⁴) is the Einstein gravitational constant (k); conversion factor, c is the speed of light, T_{μν} is the stress-energy tensor, G_{μν} is the Einstein tensor, g_{μν} is the metric tensor and Λ is the cosmological constant which was precisely calculated by Sayed in a recent work (2). The general relativity was declared in 1915 without the cosmological constant. The cosmological constant Λ was introduced by Albert Einstein to keep static universe concept into general relativity in 1917 (2).

The original field equations of Einstein without the cosmological constant (His big blunder as He said) can be given as follows (26,27, 28).

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = (8\pi G) T_{\mu\nu} \tag{4}$$



Taking into consideration the Einstein gravitational constant (k) which is equal to (1, 26, 27, 28)

$$k = 8\pi G \tag{5}$$

Let us suppose and equate the values of Newton an Einstein gravitational constants (equation 2 and 5), one gets equations 5 and 6:

$$F r^2 / m_1 m_2 = 8\pi G \tag{6}$$

$$F = 8\pi G m_1 m_2 / r^2 \tag{7}$$

This equation can be transferred to a quantum expression by the following approaches.

III.a. Using wave-particle duality formula

The fact that standard physics thinks the de Broglie wave is a true matter wave has caused much confusion in interpretations of modern physics, and one of several reasons why it has not been possible to unify gravity with quantum mechanics yet (2,29). According to the de Broglie formula of particle-wave duality nature (29):

$$\lambda = h/p \tag{8}$$



Where, λ is the wavelength, h is the Planck constant and p is the momentum (mv). This equation can be written as:

$$m^2 = h^2 / v^2 \lambda^2 \quad (9)$$

Supposing that the particle velocity almost equal to speed of light; $v \approx c$, and substituting value of m^2 of equation 9 in equation 7 considering $m_1 = m_2$, one gets:

$$F = 8\pi G h^2 / \lambda^2 r^2 \cdot c^2 \quad (10)$$

Considering the Planck length; $l_p = \sqrt{\hbar G / c^3}$ which can be given as $l_p^2 = \hbar G / c^3$. The G value can be defined and expressed as (30,16).

$$G = l_p^2 c^3 / \hbar \quad (11)$$

By substituting the value of G in equation 11 in equation number 10, one obtains:

$$F = 8\pi l_p^2 c^3 h^2 / \hbar \lambda^2 r^2 \cdot c^2 \quad (12)$$

Taking into consideration; $\hbar = h / 2\pi$, the equation number 12 can be expressed as follow:

$$F = 8\pi l_p^2 h^2 c / (h / 2\pi) \lambda^2 r^2 \quad (13)$$

$$F = 16\pi^2 l_p^2 h c / \lambda^2 r^2 \quad (14)$$

The equation 14 shows that the gravity is a force function in the square wavelength of the quanta. The equation 14 can also be given as follow:

$$\lambda^2 = 16\pi^2 l_p^2 h c / F r^2 \quad (15)$$

$$\lambda = (4 \pi l_p / r) \sqrt{h c / F} \quad (16)$$

III.a. Using Einstein mass-energy equivalence formula

By using Einstein mass-energy equivalence (2, 31), the mass can be expressed as:

$$m = E / c^2 \quad (17)$$

The equation number 17 can be given as:

$$m^2 = E^2 / c^4 \quad (18)$$

Supposing $m_1 = m_2$ in equation 7, and by substituting the value of m^2 (eq. 18) in equation 7, one gets:

$$F = G 8\pi E^2 / r^2 c^4 \quad (19)$$

Taking into consideration the quantum expression; Planck formula, of energy (1,2)

$$E = hv = h c / \lambda \quad (20)$$

Where, h is the Planck constant and λ is the wavelength. The equation 20 can also be written as follow:

$$E^2 = h^2 c^2 / \lambda^2 \quad (21)$$

By substituting value of E^2 of equation 21 in equation 19, it produces

$$F = 8\pi G h^2 c^2 / \lambda^2 r^2 \cdot c^4 \quad (22)$$

$$F = 8\pi G h^2 / \lambda^2 r^2 C^2 \quad (23)$$

Considering the Planck length definition as given in the following equation 24 and 25 (16,30):

$$l_p = \sqrt{\hbar G / c^3} \quad (24)$$

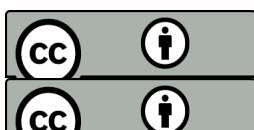
$$G = l_p^2 c^3 / \hbar \quad (25)$$

By substituting equation 25 in equation 23;

$$F = 8\pi h^2 l_p^2 c^3 / \hbar \lambda^2 r^2 C^2 \quad (26)$$

Integrating the value; $\hbar = h / 2\pi$ in equation 26, one obtains

$$F = 16\pi^2 h l_p^2 c / \lambda^2 r^2 \quad (27)$$



The value $(16\pi^2 h l p^2)$ is a universal constant called **Sayed's gravitational constant (Λ^M)**; $2.732456 \times 10^{-101} \text{ kg m}^4/\text{s}$. The equation 27 can be reduced to be as follow:

$$F = \Lambda^M (c / \Lambda^2 r^2) \quad (28)$$

Based on the formulas (nos.14, 15) and **Sayed quantum gravity force (SQGF)**; the formula given in equation 27, it can be concluded the following crucial and revolutionary axioms:

- The gravity is a force; it is not only warping and curvature of space-time fabric /geometry due to effect of objects mass.
- The gravity force is quantized and fulfills the particle-wave duality principle.
- The derived SQGF is inversely proportional to the square of the gravity quanta wavelength and distance between objects either in macroscopic or microscopic scale.
- In spite of the successful applications of Einstein mass-energy equivalence. However, speed of light is concluded to be a **variable** violating of $E=mc^2$. The faster than speed of light is a must for detection any fluctuation due to quanta of gravity force and to matching with the entanglement phenomena observations.

The equation 27 (it was also concluded in eq. 15) can also be given as;

$$\Lambda^2 = 16\pi^2 h l p^2 c / F r^2 \quad (29)$$

$$\Lambda = \sqrt{16\pi^2 h l p^2 c / F r^2} \quad (30)$$

$$\Lambda = (4 \pi l p / r) \sqrt{h c / F} \quad (31)$$

The equation 30 shows that the wavelength is proportional to force of gravity, Planck length, Planck constant, speed of light and the distance between the attracted masses.

The quantum Planck length, time, area and volume are $1.61697 \times 10^{-35} \text{ m}$, $5.39 \times 10^{-44} \text{ second}$, $2.56 \times 10^{-70} \text{ m}^2$ and $4.096 \times 10^{-105} \text{ m}^3$. While, the quantum Black hole ray (length) and time are $2.0256 \times 10^{-96} \text{ meter}$ and $6.7567 \times 10^{-105} \text{ second}$, respectively (16).

III.b Using Sayed mass-energy equivalence formula

By using Sayed mass-energy formula that was recently published and concluded violation of $E=mc^2$ (2);

$$E = 1/8 mc^2 \quad (32)$$

$$m^2 = 64 E^2 / c^4 \quad (33)$$

With considering the above mentioned derivation, the final equation will be:

$$F = 1024\pi^2 h l p^2 c / \Lambda^2 r^2 \quad (34)$$

$$\Lambda^2 = 1024 \pi^2 h l p^2 c / F r^2 \quad (35)$$

$$\Lambda = \sqrt{1024\pi^2 h l p^2 c / F r^2} \quad (36)$$

$$\Lambda = (32\pi l p / r) \sqrt{h c / F} \quad (37)$$

The same result (similar to equations 14 and 27) was also found and given in equation 34. The crucial correlation of the quantum gravity was also concluded; the gravity is a force inversely proportional to the square of the wavelength and distance and directly proportional to the Planck length.

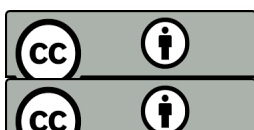
The EFT treatment of gravity breaks down at a scale of the order of the Planck mass. An internal symptom for this is that the tree level cross-section for gravitational scattering violates the unitarity bound (32).

A published article shows that Quanta such as gravitons fluctuate like waves, and the shortest wavelengths would have the most intense fluctuations (20).

All gravity is directly linked to the change in gravitational energy over the Planck time. The Planck scale has in recent years been detected or detection of gravity is detection of the Planck scale (30).

For unification of gravity and quantum mechanics, scientists have built physical devices like quantum computers to create simulations in which they can manipulate the entanglements of quantum states in a controlled way (33).

III.c. Derivation of SQGF formula based on $m_1 \neq m_2$



As given in the abovementioned derivation considering that the $m_1 \neq m_2$ in equation 7, one finally gets

$$F = 16\pi^2 h \lambda_1 \lambda_2 r^2 \tag{38}$$

Where, λ_1 and λ_2 represent the different wavelengths due to fluctuation of masses and F is the Sayed’s quantum gravity force.

IV. Verification and validation of SQGF formula

iv.a. Check of the formula units equality

The units of our formula; $F = 16\pi^2 h \lambda_1 \lambda_2 r^2$, was verified as follows:

$$N = J.s \times m^2 \times (m/s) / m^2 \times m^2 = (N.m).s \times m^2 \times (m/s) / m^2 \times m^2 \tag{39}$$

$$\text{Newton (N)} = \text{Newton (N)} \tag{40}$$

$$\text{Kg.m/s}^2 = (\text{kg.m}^2/\text{s}). m^2. (m/s) / m^2. m^2 \tag{41}$$

$$\text{Kg.m/s}^2 = \text{Kg.m/s}^2 \tag{42}$$

iv.b. Calculation of the speed of light by our formula

The speed of light was calculated using the rearrangement of the derived equations 14 and 27 as follows:

$$c = F r^2 \lambda^2 / 16 \pi^2 h \lambda_1 \lambda_2 \tag{43}$$

Considering the distance between the Sun and Earth, the wavelength is to be calculated by the abovementioned equation 29:

$$\lambda^2 = 16 (3.14159)^2. (6.626 \times 10^{-34}). (1.616 \times 10^{-35})^2. (3. \times 10^8) / (3.57 \times 10^{22}). (1.5 \times 10^{11})^2$$

$$\lambda^2 = 1020.52 \times 10^{-140} m^2 \tag{44}$$

The speed of light was calculated based on the calculated λ^2 value and found to be as follows:

$$C = (3.57 \times 10^{22}). (1.5 \times 10^{11})^2. (1020.5 \times 10^{-140}) / 16 (3.14159)^2. (6.626 \times 10^{-34}). (1.616 \times 10^{-35})^2$$

$$C = 2.9999 \times 10^8 m/s \tag{45}$$

This value is typical to the Einstein speed limit. This value was calculated based on the λ^2 value of $1020.5 \times 10^{-140} m^2$. Considering the instantaneous nature of gravity force, it necessitates that the speed of gravity quanta (e.g. Graviton or any other quanta) must be very faster than the speed of light and that the speed of light is a **variable** (2,34). By substituting the value of light speed as given in equations 32 ($E = 1/8 mc^2$; or 8 times speed of light) and 34, one may get measurable value of the gravity quanta wavelength (λ_{qc}) directly or relatively.

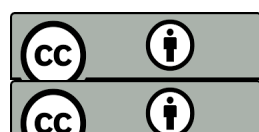
Many articles, dealt with faster than speed of light, were experimentally (e.g. Noble prize in physics of entanglement 2022) and theoretically proved and published (2,31,34). Space particle dualism states that gravity is a side effect of the other three forces. Everything that has charge has mass as well, with the mass being a side effect of the charge. Thus, photons do not have gravitational mass, pretty much in contradiction to Einstein’s general relativity (35).

iv.c. The micro and macroscopic applications of the SQGF formula

The application of the SQGF formula on micro and macroscopic scale was also carried out and given in table 1. The calculations were based on the published well known data. [ula](#)

Table 1: The micro and macroscopic scale application of the SQGF form

Scale	System	The wavelength λ^2 calculated by SQGF	Quantum gravity force
Microscopic	Planck scale (length)	$3139 \times 10^{-20} m^2$ (or $\lambda = 5.6026 \times 10^{-9} m$)	1 micro Newton (1 μ N)
	H-atom (Electron-proton)	$8.0348 \times 10^{-26} m^2$ ($2.83457 \times 10^{-13} m$)	$36.32 \times 10^{-48} N$



Macroscopic	Sun – Mercury	$11.3328 \times 10^{-137} \text{ m}^2$	$9.30 \times 10^{21} \text{ N}$
	Andromeda–Milky way	$53.341 \times 10^{-169} \text{ m}^2$	$26.68 \times 10^{29} \text{ N}$

*These calculations are based on speed of light of $3 \times 10^8 \text{ m/s}$.

Based on the results given in table 3, the calculated wavelength ($5.6026 \times 10^{-9} \text{ m}$) in the Planck scale is an experimentally measurable quantity within the range of the electromagnetic waves spectrum.

iv.d. A proposed Sun–Earth–Moon triangle of relative gravity wavelengths:

Based on the SQGF (equation14 or 27 or 34) considering the distances between Sun–Earth–Moon for example, an experiment can be arranged/ set up to detect the relative wavelengths due to quantum gravity force (see Fig. 4 & table 2):

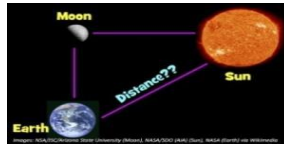


Fig. 4: The Sun–Earth–Moon relative wavelengths due to the gravitational force (NASA photo)

Table 2: A proposed correlations for detection of quantum gravity force

Distance in meter	λ^2 ratio as calculated by Sayed QGF formula	Force of quantum gravity using λ^2
S–E (Sun–Earth)	$\lambda^2_{E-M} / \lambda^2_{S-E} = 2.7437 \times 10^7$	$3.57 \times 10^{22} \text{ N}$
E–M (Earth–Moon)	$\lambda^2_{E-M} / \lambda^2_{S-M} = 3.383 \times 10^5$	$2.0 \times 10^{20} \text{ N}$
S–M (Sun–Moon)	$\lambda^2_{S-M} / \lambda^2_{S-E} = 0.81136 \times 10^2$	$4.4 \times 10^{20} \text{ N}$

Einstein recognized that since nothing, not even gravity, can travel faster than the speed of light, the Earth would not notice the *absence of gravity for 8.5 minutes*, the time it takes gravity to travel (at 300,000km/s) from the Sun to the Earth (11). This is ensuring our observation that there is faster than speed of light. The SQGF formula was also used to calculate speed of light at different wavelengths as given in table 3.

Table 3: The calculation of speed of light using different gravity quanta wavelengths

Item	λ^2 by SQGF	Calculated Speed of light	Equivalent
Based on the distance between Sun–Earth	$1020.524 \times 10^{-140} \text{ m}^2$	$3 \times 10^8 \text{ m/s}$	$^{\circ}\text{C}$
	$8.16419 \times 10^{-137} \text{ m}^2$	$2.4 \times 10^9 \text{ m/s}$	8 C
	$5.20467 \times 10^{-135} \text{ m}^2$	$1.53 \times 10^{11} \text{ m/s}$	510 C
	$(3139 \text{ m})^2$	$2.89654 \times 10^{152} \text{ m/s}$	$0.9655 \times 10^{144} \text{ C}$

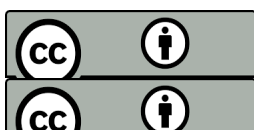
*Where C is the Einstein’s speed of light

The concept of redshift (and blue-shift) is related to the difference between the observed and emitted wavelengths of an object; the quantity called z (36). Where, $z < 0$ for blue-shift and $z > 0$ for red shift.

$$1+z = \lambda_{\text{obs}} / \lambda_{\text{emit}} \tag{46}$$

The gravity constant of Baryon was given to be $1.8513 \times 10^{-64} \text{ m}^3 \text{ kg/s}^2$ (35). While the Newton gravitational constant is $6.67 \times 10^{-11} \text{ m}^3/\text{kg.s}^2$. Yet, gravitational waves detectors measure distance differences in the realm of 10^{-19} meter (35).

An article states that both Newtonian and Einsteinium gravity are in fact so wrong, it does not come from mass, as Newton claimed, and it also does not come from energy, as Einstein claimed, but it instead comes only from the number of quarks contained within an object (37).



Conclusions

This article is a theory to solve the 100 year puzzle of quantum gravity. The **Sayed's quantum gravity force (SQGF)** formula was deduced by merging Newton, Einstein and quantum mechanics approaches. Based on the verified and validated derived formula, it could be concluded that the gravity is a force inversely proportional to the square of wavelength of gravity quanta and distance between objects. Based on the SQGF, the **violation of light speed** is a must to get calculable and measurable wavelength of the gravity quanta. The wavelengths due to quanta of gravity in the micro and macroscopic scale were calculated. It was found to be; $\lambda = 5.6026 \times 10^{-9}$ m and 2.83457×10^{-13} m (8.0348×10^{-26} m²) for Planck scale and electron-proton of hydrogen atom respectively.

Acknowledgment

My Lord and Allah (God); You and your universe are greater than imagination and capability of all the human beings. Please accept my gratitude, respect and deep cordial and mental love.

Conflict of interest

There is no any conflict with anyone concerning this article.

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