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On the Quantization of Time, Space and Gravity

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Abstract

We combine the de Broglie Matter Wave Equation with the Heisenberg Uncertainty Principle to derive an equation for time as a wave. This happens to be the first time that these two statements have been combined in this manner to derive an equation for time. The result is astounding. Time turns out to be a minuscule blob of quantum electromagnetic energy in perpetual angular momentum. From this time equation, we derive an equation for space which turns out to also predict a string (like the string of string theory). We then combine the time equation with the space equation to derive an equation for the inverse of quantum gravity which is also surprisingly electromagnetic in nature. This last statement implies that space is multidimensional and gravity in multidimensional space is not quantized, but its inverse (which is single-dimensional) is.

Keywords

Heisenberg Uncertainty Principle, de Broglie Wave Equation, String Theory, Motion in a Gravitational Field Equation, Linear Displacement, Quantum Photon Energy

1. Introduction

In this paper, the goal is to mathematically derive fundamental quantum equations for time, space and inverse gravity. The three equations show that all three quantities are electromagnetic energy in nature. Since everything known so far can only exist in space and time and must occupy space, we can safely say everything is electromagnetic energy in nature. The mathematical manipulations also show that fundamental quantum energy is much smaller than the known quantum photon energy (hf). It turns out that the new tiny energy is the inverse of the photon energy; that is, ($\frac{1}{hf}$).

2. Quantum Equations

2.1. Derivation of the Equation of Time as a Wave

According to the Heisenberg Uncertainty Principle [1]:

$$\Delta E \Delta t \geq \frac{h}{4\pi} \quad (1)$$

The symbol ≥ suggests there is a limiting condition when:

$$\Delta E \Delta t = \frac{h}{4\pi} \quad (2)$$

We can drop the delta symbol the same way we do when calculating tunneling time and express it as:

$$4\pi E t = h \quad (3)$$

Also according to the de Broglie Matter Wave Equation [2]:

$$\lambda = \frac{h}{mv} \quad (4)$$

which is called the "de Broglie wavelength" for every particle moving at a velocity v as seen by a stationary observer [3]. This can be rewritten as:

$$\lambda mv = h \quad (5)$$

Since the h in Equation (3) is the same as (h) in Equation (5), we can equate these two equations to get the following:

$$4\pi E t = \lambda mv \quad (6)$$

Since the mv on the right-hand side of Equation (6) represents momentum, the energy (E) on the left-hand side of Equation (6) must be kinetic for the two sides to balance and make sense. Both sides of the equation must be dynamic in nature.

Making time (t) to be the subject of the equation we get:

$$t = \frac{\lambda mv}{4\pi \frac{1}{2} mv^2} \quad (7)$$

Equation (7) reduces to:

$$t = \frac{\lambda}{2\pi v} \quad (8)$$

This equation establishes the following:

- Time is a wave since it has a wavelength (λ).
- Since wavelengths are the "number of units of length per wave" [4] and are countable in whole numbers, we can say that time is made up of whole number wavelengths (n).

We can therefore write Equation (8) as:

$$t = \frac{n\lambda}{2\pi v} \quad \text{where} \quad n = 1, 2, 3, \cdots \quad (9)$$

But we know, from $v = \lambda f$, that:

$$\frac{h}{v} = \frac{1}{f} \tag{10}$$

So Equation (9) becomes:

$$t = \frac{n}{2\pi f} \tag{11}$$

Since frequency is the number of wavelengths per unit time [5], the (n) in Equation (11) still makes sense since it now refers to the countable number of wavelengths per unit time.

2.2. Derivation for the Angular Momentum Equation

Let there be n wavelengths of a standing wave on the circumference of a circle; see **Figure 1**.

Then the circumference of the circle is an integral number (n) of wavelengths [6]:

$$n\lambda = 2\pi r \quad \text{where } r \text{ is the radius of the circle} \tag{12}$$

Rewriting gives:

$$\lambda = \frac{2\pi r}{n} \tag{13}$$

But from de Broglie's Matter Wave Equation in Equation (4):

$$\lambda = \frac{h}{mv}$$

Equating Equation (4) to Equation (13) we get:

$$\frac{2\pi r}{n} = \frac{h}{mv} \tag{14}$$

After cross-multiplying:

$$nh = mvr(2\pi) \tag{15}$$

Dividing both sides by (2π) yields:

$$\frac{nh}{2\pi} = mvr \tag{16}$$

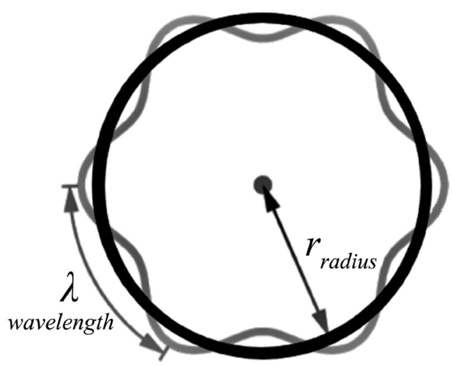

Figure 1. Standing wave on a circle.

But we know that (mvr) is angular momentum [7]; therefore, $\frac{nh}{2\pi}$ is angular momentum.

We can now turn Equation (11) into an equation of energy since the (f) in the denominator on the right-hand side of Equation (11) is a proxy symbol for quantum energy. Similarly, the term $\frac{n}{2\pi}$ on the right-hand side of Equation (11) is also a proxy for angular momentum.

Multiply the right-hand side of Equation (11) by $\frac{h}{h}$ so that:

$$t = \frac{n}{2\pi f} \times \frac{h}{h} \tag{17}$$

This can be written as:

$$t = \frac{nh}{2\pi} \times \frac{1}{hf} \tag{18}$$

In Equation (18), the first term is angular momentum and the second term is the inverse of a bundle of quantum energy.

Equation (18) can be reduced to:

$$t = \frac{nh}{2\pi E} \tag{19}$$

From the above equation, we can see that:

- Time is quantized because of the (n).
- We also see that the elementary bundle of energy is the inverse of the bundle of the photon. We could baptize it as an "inverquant".

2.3. Derivation of the Equation for Quantum Space

Equation (9) can be written as:

$$tv = \frac{n\lambda}{2\pi} \tag{20}$$

Space in a single direction can be defined by a line which is linear displacement; defined as the movement of an object in a particular direction over a certain distance [8]. This is given by:

$$vt = d \tag{21}$$

Substituting (d) for (vt) in Equation (20) and multiplying the RHS by $\frac{h}{h}$, we get:

$$d = \frac{n\lambda}{2\pi} \times \frac{h}{h} \tag{22}$$

But we know that:

$$\lambda = \frac{v}{f} \tag{23}$$

Replacing (λ) in Equation (22) by $\frac{v}{f}$ gives:

$$d = \frac{nh}{2\pi} \times \frac{v}{hf} \tag{24}$$

This can be reduced to:

$$d = \frac{nhv}{2\pi E} \tag{25}$$

This implies the following:

- Space is quantized with a combination of angular momentum represented by the term $\frac{nh}{2\pi}$.
- This angular momentum is combined with linear velocity (v). Hence, this combination might produce wobbling motion of the inverse of a bundle of photon energy. This might resemble the motion of a string as suggested in string theory [9]:

$$\frac{1}{E} = \frac{1}{hf} \tag{26}$$

2.4. Derivation of the Equation of Quantum Gravity

We use the equation of motion in a gravitational field for an object in free-fall near the Earth from rest position; see Figure 2.

The displacement is given as follows [10]:

$$d = ut + \frac{1}{2}gt^2 \tag{27}$$

Since the object falls from rest $u = 0$.

Then:

$$g = \frac{2d}{t^2} \tag{28}$$

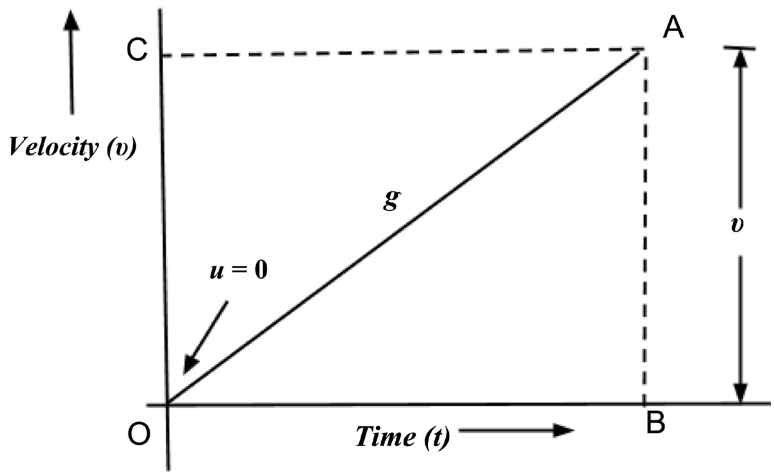

Figure 2. The area of the velocity-time graph gives the object's displacement.

By Equation (25), we see that:

$$2d = \frac{2nhv}{2\pi E} \tag{29}$$

By Equation (18), we can write:

$$t^2 = \frac{n^2h^2}{4\pi^2E^2} \tag{30}$$

Now substituting Equation (29) and Equation (30) in Equation (28) gives:

$$g = \frac{nh}{2\pi} \times \frac{2v}{hf} \times \frac{4\pi^2}{n^2h^2} \times h^2 f^2 \tag{31}$$

It reduces to:

$$g = \frac{2\pi}{nh} \times 2v \times hf \tag{32}$$

Equation (32) does not show quantization since the (n) that allows counting is in the denominator with the irrational pi in the numerator. This suggests that gravity is not quantized. However, on turning Equation (32) upside down by getting its inverse, we can write:

$$\frac{1}{g} = \frac{nh}{2\pi} \times \frac{1}{2v} \times \frac{1}{E} \tag{33}$$

Equation (33) is quantized, so the inverse of gravity is quantized.

But what is the inverse of gravity?

Does this not suggest that gravity is a value obtained from all the dimensions of space so that ($\frac{1}{g}$) appears to be the fraction of (g) we obtain when we consider only one dimension of that gravity? This then suggests gravity is multidimensional and that only a single dimension out of the total is quantized. This implies that gravity has many dimensions but if one dimension is singled out of the many, that is ($\frac{1}{g}$), then the single dimension of (g) becomes quantized.

3. Concluding Remarks

We set out to mathematically demonstrate that time, space and inverse gravity are quantized. We were also interested in establishing the fundamental nature of the three quantities. From our mathematical derivations, we can conclude the following:

1) We have just mathematically shown that time, space and inverse gravity are quantized.

2) It has also been established that each of the three quantities is fundamentally electromagnetic energy in nature.

3) We have shown that this energy is dynamic in the sense that it is perpetually in angular momentum.

4) We have also shown that while gravity is not quantized, its inverse is.

5) We further interpret the inverse of gravity to mean a fraction of gravity; that is ($1/g$). This seems to suggest that (g) is a collective value combining several dimensions such that if only one of those dimensions is considered, that is to say ($1/g$), or 1 out of (g), then the result becomes quantized.

6) On the basis of this latter argument, we have concluded that each of the three quantities is quantized with a caveat that (g) is quantized if only a single dimension of gravity is considered. This statement assumes that gravity is multi-dimensional in nature as evidenced by our mathematical manipulations and subsequent interpretation.

7) We also conclude that the energy is much smaller than quantized photon energy which is (hf). We establish that the quantum energy for each of the three quantities is ($\frac{1}{hf}$).

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Nomenclature

d: Displacement

f: Frequency

g: Gravitational constant

h: Planck's constant

m: Mass

t: Time

u: Initial velocity

v: Velocity

ΔE: Uncertainty in energy

Δt: Uncertainty in time

λ : Wavelength