

The Age of Time

(According to the Electro-Gravitational Principle)

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Abstract

In this paper I introduce a new quantum-cosmological principle that I shall call the 'electro-gravitational principle'. Based on this principle I shall derive a formula for the age of the Universe. The formula coincides with formula I published in a previous paper in 2014 and that I derived from the Scale Law. The age of the Universe obtained through this formulation agrees with the latest measurements carried out in 2013 by the Planck mission.

Keywords: *Planck's constant, Planck mass, Planck length, Planck spacecraft, gravitational coupling constant, electromagnetic coupling constant, fine-structure constant, atomic structure constant, hydrogen unit of time, Newton's gravitational constant, Bohr radius, theory of everything.*

1. Introduction

In today's physics the conviction still prevails that the unification of all forces of nature (the strong force, the electromagnetic force, the weak force* and gravity) is possible. A theory that tries to accomplish this unification is known as the theory of everything (TOE). An example of a TOE is the string theory in which there are two kind of particles: tiny closed strings which look like loops and open strings which resemble line segments. This formulation shows a connection between quantum physics and gravity through a simple principle that leads to an equation that matches the observed data obtained by the Europe's Planck spacecraft [1] [2].

* The electromagnetic and the weak forces have been unified into the electroweak theory.

2. Nomenclature

I shall use the following nomenclature for the constants and variables used in this paper

α_G = gravitational coupling constant for the proton

T = age of time (age of the Universe or Universal age)

α = electro-magnetic coupling constant (fine-structure constant or atomic structure constant).

t_H = hydrogen unit of time.

c = speed of light in vacuum

h = Planck's constant
 G = Newton's gravitational constant
 e = elementary charge
 ϵ_0 = permittivity of vacuum
 m_e = electron rest mass
 m_p = proton rest mass
 M_p = Planck mass
 a_0 = Bohr radius (hydrogen atomic radius corresponding to the quantum number $n = 1$)

3. The Electro-Gravitational Principle

The electro-gravitational principle is a new and simple principle which relates gravity with electromagnetism. The electro-gravitational principle states that

The electro-gravitational principle

The product of the gravitational coupling constant times the age of the Universe is equal to the product of the electromagnetic coupling constant times the hydrogen unit of time.

Mathematically:

$$\alpha_G T = \alpha t_H \quad (2.1)$$

The gravitational coupling constant for the proton is defined as

$$\alpha_G \equiv \left(\frac{m_p}{M_p} \right)^2 \quad (2.2)$$

The Planck mass is defined as

$$M_p \equiv \sqrt{\frac{hc}{2\pi G}} \quad (2.3)$$

The electromagnetic coupling constant (fine-structure constant) is

$$\alpha \equiv \frac{e^2}{2\epsilon_0 h c} \quad (2.4)$$

The hydrogen unit of time is defined as follows

Hydrogen unit of time

Time taken by a photon to travel a distance equal to the diameter, $2a_0$, of the hydrogen atom. Where a_0 is the Bohr radius: $a_0 = 0.529\ 177\ 210\ 92(17) \times 10^{-10} m$

Mathematically

$$t_H \equiv \frac{2a_0}{c} = \frac{1}{\pi \alpha} \frac{h}{m_e c^2} \quad (2.5)$$

In the following section I shall derive the age of time from the above equations.

4. Derivation of the Age of Time

Now lets us use the equations of the previous section to find the age of the Universe. From equation (2.1) we have

$$T = \frac{\alpha}{\alpha_G} t_H \quad (3.1)$$

Now from equations (2.2), (2.3) and (2.5) and (3.1) we get

$$T = \frac{\alpha}{m_p^2} \left(\frac{hc}{2\pi G} \right) \left(\frac{1}{\pi \alpha} \frac{h}{m_e c^2} \right) \quad (3.2)$$

Finally, after simplification, we get the formula for the age of the Universe

Formula for the age of the Universe

$$T = \frac{h^2}{2\pi^2 c G m_e m_p^2} \quad (3.3)$$

The formula coincides with formula I published in a previous paper in 2014 and that I derived from the Scale Law [3]. Expressed in seconds the age of the Universe turns out to be

$$T = 4.362\ 157\ 043 \times 10^{17} S = 4.362 \times 10^{17} S$$

Expressed in Julian years the age of the Universe is

$$T = \frac{4.362\ 157\ 043 \times 10^{17} S}{365.25 \times 24 \times 60 \times 60 S / year} = 1.382\ 284\ 154 \times 10^{10} years$$

Converting to million years we get

Age of the Universe

$$T \approx 13,822.84 \text{ million years}$$

Finally, converting to billion years we get

Age of the Universe

$$T \approx 13.823 \text{ billion years}$$

So time, as we know it (the time we are familiar with), was created 13.8 billion years ago in a Meta-transformation known as the Big Bang. However since the Big Bang marked the beginning of normal time, one can ask: Was there time before the Big Bang? The answer is yes; however there are two possibilities. The first possibility is that the Big Bang was only the creation of space and matter from two already existing “ingredients”: energy and time. The second possibility is that there was another kind of time before normal time – a time called Meta-time and also another type of energy called Meta-energy, as I like to call it. This, sooner or later, will lead us to ask the following question: Where do the laws of physics come from? The answer to this question can be found in another paper [4].

5. Conclusions

In summary, I have introduced a new principle that I have called *the electro-gravitational principle*. Because the age of the Universe always increases, the principle suggests that at least one of the other parameters (α_G, α, t_H) must vary with the universal time. The equation presented here tells us something deep and important about Nature: this formulation implies that ordinary quantum theory and gravitation are deeply linked and that a new and radical theory of “everything” is not only required as a fundamental theory of Nature but it should also be possible to achieve.

Another new insight is that the existence of energy (or Meta-energy) and time (or Meta-time) before the Big Bang explains why there are two uncertainty principles: the *Heisenberg energy-time uncertainty relation* which is a solid evidence of the existence of a Meta-Universe, and the *Heisenberg momentum-space uncertainty relations* which are a material “replica” of the energy-time counterpart.

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