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# Interpretation of Planck Length, Time and Mass by a Model of Critical Size Cluster of Gravitons

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***[Abstract]***
*It is suggested by some scientists that Planck Units including Planck Length, Planck Time and Planck Mass are representing the fundamental physical scales in the universe such as the size and mass of God's particle, and the formation time of the universe. A model of critical size cluster of gravitons is proposed intentionally to explain the meanings of Planck Units based on Graviton Radiation and Contact Interaction Theory. As a result, Planck Length, Plank Time and Planck Mass does indicate some correlations to the length, time and mass of the critical size cluster of gravitons, also to Wu Unit Length, Wu Unit Time and Wu Unit Mass. But by no means are Planck Units the fundamental unit quantities of God's Particle (such as Wu's Pair). Furthermore, it is realized that only the parent object bigger than some critical size cluster of gravitons can generate sufficient graviton flux based on Graviton Radiation and Contact Interaction Theory and to fulfill Newton's Law of Universal Gravitation. This explains why Planck Mass is much bigger than that of the subatomic particles.*

***[Keywords]***
*Planck Length, Planck Time, Planck Mass, Planck Units, Planck Constant, Wu's Pair, Wu's Unit Length, Wu's Unit Time, Wu's Unit Mass, Newton's Law of Universal Gravitation, Graviton, Gravitational Force, Gravitational Constant, Graviton Flux, Graviton Radiation, Photon, Light Speed.*

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## I. Background

Planck Units including Planck Length, Planck Time and Planck Mass are defined exclusively by three physical constants: c, G and ħ. Some scientists believe that they are the smallest scales in the universe, even though the real physical meanings are not fully understood. In fact, Planck Length $1.616255\times10^{-35}$ m and Plank Time $5.39\times10^{-44}$ s are extremely small, but unexpectedly Planck Mass $2.176434 \times 10^{-8}$ kg (equivalent to $1.22 \times 10^{19}$ Gev) is much bigger than that of all the subatomic particles (for example, Top Quark 171.2 Gev). It has caused a great deal of confusion.

On the other hand, Wu's Pairs are proposed as the building blocks of all matters in the universe based on Yangton and Yington Theory [1]. It is obvious that Wu Units including Wu Unit Length, Wu Unit Time and Wu Unit Mass are the smallest quantities in the universe. Therefore, it is expected that both Planck Units and Wu Units are in the same magnitudes if both of them are the same God's Particles.

With the attempt of better understanding of Planck Units, a critical size cluster of gravitons (revised from my previous publication [2]) is used as the model to calculate Planck Length, Planck Time and Planck Mass. The correlations of the size, time (light traveling time across the cluster) and mass of the critical size cluster of gravitons with respect to Planck Length, Time and Mass, and also that to Wu Unit Length, Wu Unit Time and Wu Unit Mass are studied and analyzed in this paper.

## II. Yangton and Yington Theory

Yangton and Yington Theory [1] is a hypothetical theory based on a pair of superfine Yangton and Yington antimatter particles with built-in inter-attractive Force of Creation circulating against each other on an orbit. These pairs of Yangton and Yington circulating particles are named "Wu's Pairs" which is considered as the building blocks of the universe.

Yangton and Yington Theory can be used successfully in explanation of that subatomic particles with string structures are built upon Wu's Pairs and String Force in compliance with String Theory, also String force and Four Basic Forces are induced from Force of Creation in accordance to Unified Field Theory.

Furthermore, Yangton and Yington Theory can very well bridge Quantum Theory with Relativity, also interprets and correlates space, time, energy and matter in the universe. Therefore, it is believed that Yangton and Yington Theory is a theory of everything.

## III. Graviton and Gravitational Force

Based on Yangton and Yington Theory, Wu's Pairs are the Building Blocks of the universe. When two Wu's Pairs come together with the same circulation direction (either spin up or spin down), they can stack up on each other at a locked-in position, where Yangton of the first Wu's Pair lines up to the Yington of the second one due to the attractive force between Yangton and Yington particles from each Wu's Pairs. This attractive force is called "String Force". By repeating this stacking process, various linear structures can be formed such as single string, multiple strings and ball type strings, etc. The single string structure is named "Graviton" [3].

When two gravitons come together side by side, no matter the circulation directions, they can adjust themselves so as to attract each other at the contact points by a group of string forces generated between the Yangtons of one graviton and the Yingtons of the other graviton in each cycle of circulations. This process is called "Contact Interaction" and the group of attraction only string forces generated between the two adjacent gravitons in the same object is named "Gravitational Force". Other elementary subatomic particles having basic string structures such as quarks, leptons and bosons can also have gravitational forces between them, except photon and gluons which don't have string structures or adjustable circulations.

## IV. Graviton Radiation and Contact Interaction

Like photon, graviton can also be radiated from a parent object by absorbing thermal or kinetic energy. This process is called "Graviton Radiation". As a graviton emitted from the parent object reaches the target object, it makes a contact side by side with the graviton on the target object where the two gravitons can adjust themselves so as to attract each other at the contact points by a group of string forces [3] generated between the Yangtons of one graviton and the Yingtons of the other graviton in each cycle of circulations. This interaction is called "Contact Interaction" and this group of string forces generated between two gravitons from different objects is called "Remote Gravitational Force". Also, the entire process is called "Graviton Radiation and Contact Interaction Theory" [4]. In general, Remote Gravitational Force contains "a group of gravitational forces" generated by the contact interactions between two groups of gravitons, one group from target object and the other group through graviton flux from parent object. It is different from the ordinary gravitational force which is "a single gravitational force" generated by the contact interaction between two adjacent gravitons on the same object. In addition, Remote Gravitational Force applied on target object is always towards to the opposite direction of the graviton flux from parent object.

As a result, instead of being produced by the propagation of gravitational force generated from parent object, Universal Gravitation as the remote gravitational force is generated by Graviton Radiation and Contact Interaction process between two objects. In fact, gravitational force cannot propagate by itself, only gravitons can move as part of graviton flux through graviton radiation process from parent object to target object and such that Remote Gravitational Force can be produced.

## V. Planck Units

In particle physics and physical cosmology, Planck Units (Table 1) are a system of units of measurement defined exclusively in terms of four universal physical constants: c, G, ħ, and $k_b$ [5]. They are a system of natural units, defined using fundamental properties of nature (specifically, properties of free space) rather than properties of a chosen prototype object. Originally proposed in 1899 by German physicist Max Planck [6], they are relevant in research on unified theories such as quantum gravity.

| Name | Dimension | Expression | Value (SI units) |
|---|---|---|---|
| Planck length | length (L) | $l_P = \sqrt{\frac{\hbar G}{c^3}}$ | 1.616 255(18) × $10^{-35}$ m |
| Planck mass | mass (M) | $m_P = \sqrt{\frac{\hbar c}{G}}$ | 2.176 434(24) × $10^{-8}$ kg |
| Planck time | time (T) | $t_P = \sqrt{\frac{\hbar G}{c^5}}$ | 5.391 247(60) × $10^{-44}$ s |
| Planck temperature | temperature (Θ) | $T_P = \sqrt{\frac{\hbar c^5}{G k_B^2}}$ | 1.416 784(16) × $10^{32}$ K |

Table 1 Values of Planck Length, Planck Mass, Planck Time and Planck Temperature. (speed of light C = 299792458 $ms^{-1}$, gravitational constant G = 6.673(10) x $10^{-11}$ $m^3kg^{-1}s^{-2}$, Planck's constant (reduced) ħ = h/2π = 1.054571596(82) x $10^{-34}$ $kgm^2s^{-1}$, Boltzmann constant $K_b$ = 1.3806502(24) x $10^{-23}$ $kgm^2s^{-2}K^{-1}$).

A. Planck length

Since the 1950s, it has been speculated that the Planck Length ($l_p$) 1.616255×$10^{-35}$ m is the shortest physically measurable distance, since any attempt to investigate the possible existence of shorter distances, by performing higher-energy collisions, would result in black hole production. Higher-energy collisions, rather than splitting matter into finer pieces, would simply produce bigger black holes [7]. In addition, the strings of string theory are modeled to be on the order of the Planck Length. In contrast, because Wu's Pairs are proposed as the building blocks of all matters, Wu Unit Length (diameter of Wu's Pair) must be the smallest length in the universe. Also Wu's Pairs can be break down and destroyed in the black hole. Therefore, Planck Length could very well be the same as Wu Unit Length.

B. Planck time

Planck time ($t_P$) is the time required for light to travel a distance of 1 Planck length in vacuum, which is a time interval of approximately 5.39×$10^{-44}$ s. No current physical theory can describe timescales shorter than the Planck time, such as the earliest events after the Big Bang [8]. Some speculate states that the structure of time need not remain smooth on intervals comparable to the Planck time. In contrast, Wu Unit Time is the period of the circulation of Wu's pairs. According to Wu's Spacetime Equation, $t_{yy} = \gamma l_{yy}^{3/2}$. However, if $l_p$ = l en $t_{yy}$ = $l_{yy}/C = l_p/C = t_p$. Therefore, Planck Time could also be the same as Wu Unit Time.

C. Planck Mass

It is unexpected that Planck Mass 2.176434 x $10^{-8}$ kg (equivalent to 1.22 x $10^{19}$ Gev)) is much bigger than the mass of all the subatomic particles (for example, the mass of top quark is 171.2 Gev). Since Wu's Pairs are proposed as the building blocks of all matters in the universe, therefore Wu Unit Mass must be smaller than that of all the subatomic particles. Why Planck Mass is much bigger than Wu Unit Mass remains a great confusion.

D. Planck Scale

The term Planck scale refers to quantities of space, time, energy and other units that are similar in magnitude to corresponding Planck units. This region may be characterized by energy-equivalent Planck Mass of around $10^{19}$ GeV or $10^9$ J, Planck Time of around 5×$10^{-44}$ s and Planck Length of around $10^{-35}$ m. At the Planck scale, the predictions of the Standard Model, quantum field theory and general relativity are not expected to apply, and quantum effects of gravity are expected to dominate. One example is represented by the conditions in first $10^{-43}$ seconds of our universe after the Big Bang, approximately 13.8 billion years ago. In contrast, based on Yangton and Yington Theory, it is believed that Yangton and Yington Bubbles [9] were generated in the very early stage of the universe (such as in the first $10^{-43}$ seconds). And consequently, Wu's Pairs, the building blocks of all matters in the universe were formed.

## VI. Planck Units Based on Wu's Pair Model

Planck Length, Time and Mass are defined exclusively in terms of three universal physical constants: c, G and ħ. These three constants can be calculated and correlated by the transformation of gravitational potential energy to the kinetic energy of Wu's Pair and the kinetic energy of photon, based on a physical model of two adjacent Wu's Pairs. As a consequence, the correlations of Planck Length, Time and Mass with respect to Wu Unit Length, Time and Mass can be obtained.

A. Planck Length and Wu Unit Length

According to Newton's Law of Universal Gravitation, assuming a single Wu's Pair can be applied either as a parent object or a target object, and then the gravitational force $F_{yy}$ between two adjacent Wu's Pairs is proportional to the square of Wu Unit Mass ($m_{yy}$) and the inverse square of Wu Unit Length ($l_{yy}$).

$F_{yy} = Gm_{yy}^2/l_{yy}^2$

Also, the potential energy $E_{yy}$ of a Wu's Pair $E_{yy}$ can be represented as follows:

$E_{yy} = Gm_{yy}^2/l_{yy}$

Therefore,

$$G = E_{yy}l_{yy}/m_{yy}^2$$

The kinetic energy $K_{yy}$ of Wu's Pair can be converted from the potential energy $E_{yy}$ of Wu's Pair,

Because

$K_{yy} = ½\, m_{yy}\, C^2$

Therefore,

$$E_{yy} = ½\, m_{yy}\, C^2$$

This kinetic energy $K_{yy}$ is further converted to the bonding energy $E_s$ (string energy) between the two Wu's Pairs to form a part of subatomic particle (string structure) [3].

Furthermore, as a Wu's pair separates from subatomic particle to become a photon (free Wu's Pair) [10], it possesses a kinetic energy E that is converted from string energy $E_s$.

Because

$E = E_s = K_{yy} = E_{yy}$

$E = h\nu$

Therefore,

$E_{yy} = h\nu$

Where the frequency of the photon ν is the same as that of Wu's Pair circulation frequency.

Assuming the wavelength λ of the photon is equal to the diameter of Wu's Pair $l_{yy}$,

$C = \lambda\, \nu = l_{yy}\, \nu$

Therefore,

$E_{yy} = hC/l_{yy}$

And

$$h = E_{yy}l_{yy}/C$$

Also

$\hbar = h/2\pi$

Because Planck Length is defined as $l_p = (G\hbar/C^3)^{1/2}$, therefore Planck Length $l_p$ can be calculated as follows:

$l_p = (G\hbar/C^3)^{1/2} = (2\pi)^{-1/2} (Gh/C^3)^{1/2} = (2\pi)^{-1/2}[(½\, m_{yy}\, C^2\, l_{yy}/m_{yy}^2)(½\, m_{yy}\, C^2\, l_{yy}/C)/C^3]^{1/2} = ½\, (2\pi)^{-1/2}\, l_{yy}$

$$l_p = ½\, (2\pi)^{-1/2}\, l_{yy}$$

As a result, Planck Length is in the same magnitude as that of Wu Unit Length. Since Wu's Pairs are the building blocks of all the matters in the universe, therefore, Planck Length $1.616255\times10^{-35}$ m as Wu Unit Length is the smallest nature length in the universe.

B. Planck Time and Wu Unit Time

Planck Time is defined as the time required for light to travel a distance of 1 Planck length in vacuum, therefore Planck Time $t_p$ can be calculated as follows:

$t_p = l_p/C = (G\hbar/C^5)^{1/2} = (2\pi)^{-1/2} (Gh/C^5)^{1/2} = ½\, (2\pi)^{-1/2}\, l_{yy}/C = ½\, (2\pi)^{-1/2}\, (1/\nu)$

Assuming $t_{yy} = 1/\nu$,

Therefore,

$$t_p = ½\, (2\pi)^{-1/2}\, t_{yy}$$

As a result, Planck Time has the same magnitude as that of Wu Unit Time. Since Wu's Pairs are the building blocks of all the matters in the universe, therefore, similar to that of Planck Length, Planck Time $5.39\times10^{-44}$ s as Wu Unit Time is the smallest nature time in the universe.

C. Planck Mass and Wu Unit Mass

Planck Mass is defined as $m_p = (\hbar C/G)^{1/2}$, therefore Planck Mass $m_p$ can be calculated as follows:

$m_p = (2\pi)^{-1/2} (hC/G)^{1/2} = (2\pi)^{-1/2}\, El_{yy}/(El_{yy}/m_{yy}^2)^{1/2} = (2\pi)^{-1/2}\, m_{yy}$

$$m_p = (2\pi)^{-1/2}\, m_{yy}$$

As a result, Wu Unit Mass is also in the same magnitude as that of Planck Mass. But in fact, there is a big difference between them. On one hand, because Wu's Pairs are the building blocks of all matters, Wu Unit Mass should be the smallest mass in the universe. On the other hand, Planck Mass is 2.176434 x $10^{-8}$ kg (equivalent to 1.22 x $10^{19}$ Gev) which is much bigger than that of all subatomic particles (For example, top quark has a mass of 171.2 GeV). This conflict has caused a great deal of confusion. One possible answer based on Graviton Radiation and Contact Interaction Theory, is that Newton's Law of Universal Gravitation (static remote gravitational force) can only be applied on a cluster of gravitons with critical size capable of generating sufficient static graviton flux [11], rather than a single Wu's Pair which is not capable of producing any graviton flux.

## VII. Planck Units Based on Graviton Cluster Model

To avoid the above conflict, instead of Wu's Pair ($m_{yy}$), a critical size cluster of gravitons ($m_c$) [2] as parent object that could generate sufficient static graviton flux is used as the model for the calculations of Planck Length, Time and Mass. The potential energy of a Wu's Pair at distance $l_c$ (radius) from the center of the critical size cluster of gravitons can be calculated as follows:

$E_{yy} = Gm_{yy}m_c/l_c$

Therefore,

$$G = E_{yy}l_c/m_{yy}m_c$$

Where $l_c$ is the distance between $m_{yy}$ and $m_c$ which is the radius of the critical size cluster of gravitons.

$E_{yy}$ is then converted to kinetic energy $K_{yy}$ of the Wu's Pair.

Because

$K_{yy} = ½\, m_{yy}\, C^2$

Therefore,

$$E_{yy} = ½\, m_{yy}\, C^2$$

Finally $K_{yy}$ becomes the string energy $E_s$ to bond the Wu's pair to the critical size cluster of gravitons.

When a photon emitted from the surface of the critical size cluster of gravitons, string energy $E_s$ becomes the kinetic energy E of the photon.

Because

$E = E_s = K_{yy} = E_{yy}$

$E = h\nu$

Therefore,

$E_{yy} = h\nu$

Assuming the wavelength λ of the photon is equal to the diameter of Wu's Pair $l_{yy}$ (revised from [2]),

$C = \lambda\, \nu = l_{yy}\, \nu$

Therefore,

$E_{yy} = hC/l_{yy}$

And

$$h = E_{yy}l_{yy}/C$$

Also

$\hbar = h/2\pi$

Therefore,

$l_p = (G\hbar/C^3)^{1/2} = (2\pi)^{-1/2} (Gh/C^3)^{1/2} = (2\pi)^{-1/2}[(½\, m_{yy}\, C^2 l_c/m_{yy}m_c)(½\, m_{yy}\, C^2 l_{yy}/C)/C^3]^{1/2} = ½\, (2\pi)^{-1/2} (m_{yy}/m_c)^{1/2}(l_{yy}/l_c)^{1/2}\, l_c$

Because

$l_{yy}/l_c = (m_{yy}/m_c)^{1/3}$

Therefore,

$$l_c = 2(2\pi)^{1/2} (m_{yy}/m_c)^{-2/3} l_p$$

And

$t_p = l_p/C$

$t_p = l_p/C = ½\, (2\pi)^{-1/2} (m_{yy}/m_c)^{2/3} l_c/C$

Also,

$t_c = l_c/C$

Therefore,

$$t_c = 2(2\pi)^{1/2} (m_{yy}/m_c)^{-2/3}\, t_p$$

In addition,

$m_p = (\hbar C/G)^{1/2} = (2\pi)^{-1/2} (hC/G)^{1/2} = (2\pi)^{-1/2} ((E_{yy}l_{yy}/C)C/(E_{yy}l_c/m_{yy}m_c))^{1/2} = (2\pi)^{-1/2} (l_{yy}/l_c)^{1/2} (m_{yy}m_c)^{1/2} = (2\pi)^{-1/2} ((m_{yy}/m_c)^{1/3})^{1/2} (m_{yy}/m_c)^{1/2} m_c = (2\pi)^{-1/2} (m_{yy}/m_c)^{2/3} m_c$

Therefore,

$$m_c = (2\pi)^{1/2} (m_{yy}/m_c)^{-2/3}\, m_p$$

Furthermore, assuming $t_{yy} = 1/\nu$, then

$$t_{yy} = l_{yy}/C$$

As a reasonable simulation, if $m_c \approx 10^{72} m_{yy}$ (revised from [163]), then $l_c \approx 10^{48} l_p$, $t_c \approx 10^{48} t_p$, $m_c \approx 10^{48} m_p$ and $m_p \approx 10^{24} m_{yy}$.

Also,

$l_{yy}/l_c = (m_{yy}/m_c)^{1/3}$

$l_{yy}/10^{48} l_p = (m_{yy}/10^{72} m_{yy})^{1/3} = 10^{-24}$

Therefore,

$l_{yy} \approx 10^{24} l_p$

In other words, if the mass of the critical size cluster of gravitons ($m_c$) is $10^{72}$ times bigger than Wu Unit Mass ($m_{yy}$), then Planck Mass ($m_p$) should be $10^{24}$ times bigger than Wu Unit Mass ($m_{yy}$), Planck Length ($l_p$) is $10^{24}$ times smaller than Wu Unit Length ($l_{yy}$), and Planck Time ($t_p$) is $10^{48}$ times smaller than $t_c$ (defined by $l_c/C$).

As a result, based on the definitions, it is calculated that Planck Mass ($m_p$) is $10^{19}$ Gev, Planck Length ($l_p$) is$10^{-35}$ m and Planck Time ($t_p$) is $10^{-44}$ s. Furthermore,, according to the above simulation, by assuming $m_c = 10^{72} m_{yy}$ (revised from [2]), the mass of the critical size cluster of gravitons ($m_c$) is about $10^{67}$ Gev ($10^{40}$ kg, $10^{14}$ times bigger than the mass of earth$10^{24}$ kg), the wavelength ($l_c$) is about $10^{13}$ m ($10^5$ times bigger than the diameter of earth $10^8$ m), and the light traveling time ($t_c = l_c/C$) is about $10^4$ s. Also, Wu Unit Mass ($m_{yy}$) is about $10^{-5}$ Gev (100 times smaller than Up Quark 2.3 Mev), Wu Unit Length ($l_{yy}$) is about $10^{-11}$ m and Wu Unit Time ($t_{yy}$) is about $10^{-19}$ s. All these simulation results sound reasonable except Wu Unit Length should be several orders smaller and the critical size cluster of graviton is a little big than expectation (Assuming $m_c \approx 10^{48} m_{yy}$ results in a small $l_{yy} \approx 10^{-19}$ m, but too big a $m_{yy} \approx 10^3$ Gev).

In conclusion, Planck Length, Plank Time and Planck Mass does indicate some correlations to the length, time and mass of the critical size cluster of gravitons, also to Wu Unit Length, Wu Unit Time and Wu Unit Mass. But by no means are Planck Units the fundamental unit quantities of God's Particle (such as Wu's Pair) as some scientists have suggested.

Furthermore, it is realized that only the parent object bigger than the critical size cluster of gravitons can generate sufficient graviton flux based on Graviton Radiation and Contact Interaction Theory and to fulfill Newton's Law of Universal Gravitation. Thus, it explains why Planck Mass is much bigger than that of the subatomic particles.

## VIII. Conclusions

It is suggested by some scientists that Planck Units including Planck Length, Planck Time and Planck Mass are representing the fundamental physical scales in the universe such as the size and mass of God's particle, and the formation time of the universe. A model of critical size cluster of gravitons is proposed intentionally to explain the meanings of Planck Units based on Graviton Radiation and Contact Interaction Theory. As a result, Planck Length, Plank Time and Planck Mass does indicate some correlations to the length, time and mass of the critical size cluster of gravitons, also to Wu Unit Length, Wu Unit Time and Wu Unit Mass. But by no means are Planck Units the fundamental unit quantities of God's Particle (such as Wu's Pair). Furthermore, it is realized that only the parent object bigger than some critical size cluster of gravitons can generate sufficient graviton flux based on Graviton Radiation and Contact Interaction Theory and to fulfill Newton's Law of Universal Gravitation. This explains why Planck Mass is much bigger than that of the subatomic particles.

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