

Gravitational Time Dilation in Pendulum Swings

Edward T. H. Wu

[Abstract]

According to Yangton and Yington Theory, gravitational time dilation is caused by the variation of Wu Unit Time (circulation period of Wu's Pairs) due to the different remote gravitational forces generated by graviton fluxes based on Graviton Radiation and Contact Interaction Theory. In case of static graviton flux (stationary target), the strength of the remote gravitational force is dependent on the shape, mass and distance of the target object, as is Newton's Universal Gravitation. In case of dynamic graviton flux (moving target), it is further dependent on the relative moving speed and direction between the target and parent objects.

Recently, Giorgio Toro did a pendulum swing experiment with various arrangements. The pendulums have a fixed mass at the same distance from earth, also the same speed and moving angle at all corresponding positions, as well as the same cross projection area (same shape factor) under the gravitational force on earth, in other words, the pendulums have the same dynamic remote gravitational force at all corresponding positions, therefore, a fixed mass pendulum swinging at 90° to the swing plane must have the same running rate as that swinging in parallel to the swing plane. Thus, no Gravitational Time Dilation should be detected. This opposes Giorgio Toro's original claims to his incorrect experiments and the wrong analyses in my previous publications.

[Keywords]

Time Dilation, Gravitational Time Dilation, Cosmological Time Dilation, Pendulum Swing, Altitude Time Dilation, Air Bound Time Dilation, Graviton Flux, Graviton Bombardment, Static Graviton Flux, Dynamic Graviton Flux, Remote Gravitational Force, Static Remote Gravitational Force, Dynamic Remote Gravitational Force, Graviton Radiation and Contact Interaction, Yangton and Yington Theory, Wu's Pairs, Force of Creation, Wu Unit Length, Wu Unit Time, Wu's Spacetime Equation, Principle of Parallelism, Wu's Spacetime Transformation, Wu's Spacetime Shrinkage Theory

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I. 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" [1][2], which is considered as the building blocks of all matters in the universe (Fig.1).

Yangton and Yington Theory can explain that elementary subatomic particles such as quarks, electrons, neutrinos, gluons, photons and gravitons are basic string structures composed of Wu's Pairs with String Forces. It complies very well with Quantum Field Theory [3] and String Theory [4]. In addition, Four Basic Forces including electromagnetic, weak, strong and gravitational forces are made of String Forces [2] induced from Force of Creation. It agrees with Unified Field Theory [5].

Furthermore, Yangton and Yington Theory can bridge Quantum Theory [3] with General Relativity [6], also interprets and correlates space, time, energy and matter in the universe. Therefore, it is believed that Yangton and Yington Theory is not only a Unified Field Theory but also a theory of everything.

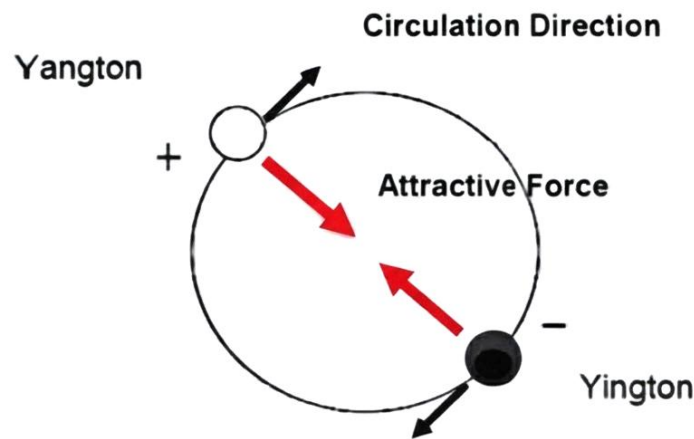


Fig. 1 Wu's Pair - a Yangton and Yington circulating pair.

II. 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 one Wu's Pair lines up to the Yington of the other one due to the attractive force generated between Yangton and Yington particles from each Wu's Pair. This attractive force is called "String Force". By repeating this stacking process, various linear structures can be formed such as single strings, multiple strings and ball type strings, which comply very well with String Theory. The one-dimension single string structure is named "Graviton".

As two adjacent gravitons in the same object 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 alternating string forces generated between the Yangtons of one graviton and the Yingtons of the other graviton in each cycle of the circulations. This process is called "Contact Interaction". The group of attraction only alternating string forces generated between the two adjacent gravitons in the same object is named "Gravitational Force" (short-range gravitational force) (Fig. 2). This is different from "Newton's Universal Gravitation" (long-range gravitational force) that is generated between two gravitons: one emitted from parent object and the other stayed on target object (Fig. 3).

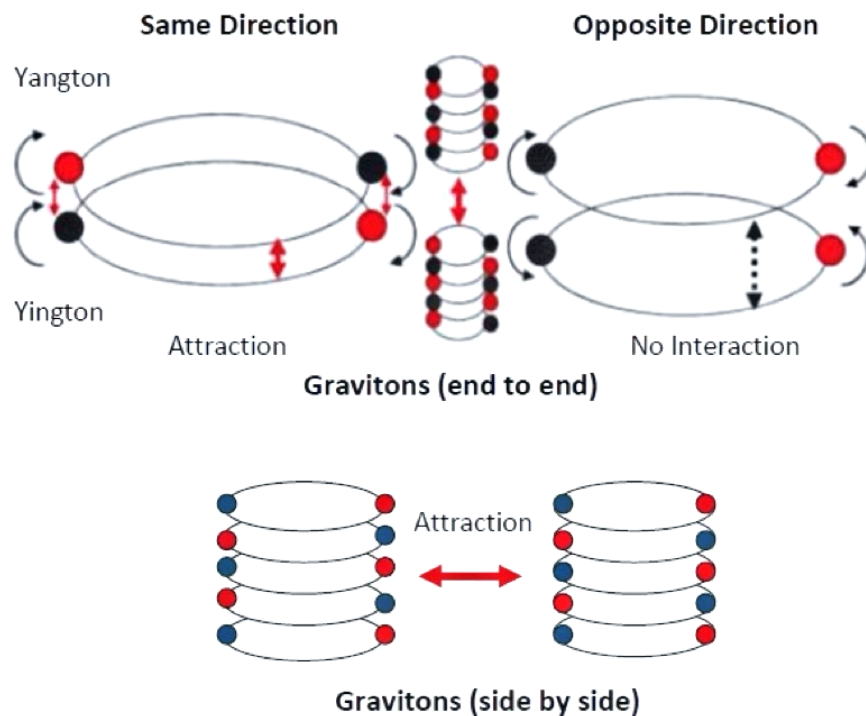


Fig. 2 Gravitational force between two graviton particles

In addition to gravitons, other elementary subatomic particles having basic string structures such as quarks, leptons and bosons can also generate gravitational forces, except photon and gluons which have neither string structure nor adjustable circulation.

III. Graviton Radiation and Contact Interaction and Remote Gravitational Force

“Graviton Radiation” is the radiation of gravitons from a parent object by absorbing either thermal or kinetic energy. As a graviton emitted from the parent object reaches the target object, it makes an interactive contact (not necessarily a physical contact) side by side with the other graviton on the target object to generate an attractive force, where the two gravitons can adjust themselves so as to attract each other at the contact points by a group of alternating string forces generated between the Yangtons of one graviton and the Yingtons of the other graviton in each cycle of circulation. This interaction is called “Contact Interaction” (Fig. 2) and the attractive force is called “remote gravitational force” (Newton’s Universal Gravitation), also the entire process is called “Graviton Radiation and Contact Interaction” [7] (Fig. 3).

During contact interaction, the gravitational potential energy carried by the graviton emitted from the parent object through graviton radiation is transferred to the graviton on the target object, such that the target object is pulled by the remote gravitational force toward parent object to a corresponding distance. Meantime the emitted graviton after energy transformation becomes a normal graviton on the target object.

Furthermore, there are two types of remote gravitational forces: Static Remote Gravitational Force generated by Static Graviton Flux with both parent and target objects stationary to each other; and Dynamic Remote Gravitational Force generated by Dynamic Graviton Flux with both parent and target objects in relative motion with respect to each other. Newton’s Universal Gravitation is a static remote gravitational force. It is not a force generated at the parent object and propagates from the parent object to the target object. In fact, gravitational force cannot propagate, only gravitons generated at the parent object can move with graviton flux through graviton radiation from parent object to target object.

IV. Graviton Fluxes

Graviton flux is generated by graviton radiation; it is the graviton streams emitted from parent object to target object. There are two types of graviton fluxes: static graviton flux and dynamic graviton flux [8][9][10].

Static graviton flux is the graviton flux emitted from a parent object to a stationary target object observed at the stationary target object. The intensity of static graviton flux is dependent on the speed of static graviton flux, mass of parent object and the distance between parent object and the stationary target object.

Dynamic graviton flux on the other hand is the graviton flux emitted from parent object to a moving target object observed at moving target object, which is dependent on the speed of dynamic graviton flux observed at moving target object, mass of parent object and the distance between the parent object and the moving target object. Based on Equation of Relative Velocity, the velocity of dynamic graviton flux observed at target object is the vector summation of the velocity of parent object observed at target object and the velocity of static graviton flux observed as parent object.

According to Wu's Spacetime Shrinkage Theory, Wu Unit Length and Wu Unit Time of the subatomic particles in an object or event are dependent on the local gravitational field (more accurately, total graviton bombardment strength or total intensities of graviton fluxes). Furthermore, based on Wu's Spacetime Transformation (in accordance with Principle of Parallelism and Wu's Spacetime Equation), all the properties of an object or event such as the dimension, duration, velocity and acceleration of an object or event, as well as wavelength [11] and light speed [12] of a photon and time dilation [13][14] of a clock, are dependent on Wu Unit Length and Wu Unit Time of the subatomic particles in the object or event. Therefore, all those properties are also dependent on the local gravitational field (more accurately, total graviton bombardment strength or total intensities of graviton fluxes).

Since the intensity of dynamic graviton flux is further dependent on the speed of graviton observed at target object which can vary with the relative motion between target object and parent object, therefore, those properties as functions of the local gravitational field (more accurately, total graviton bombardment strength or total intensities of graviton fluxes) can also be affected by the relative motion between parent object and target object.

V. Newton's Law of Universal Gravitation and Static Graviton Flux

According to Graviton Radiation and Contact Interaction Theory, Newton's Law of Universal Gravitation [16] as Static Remote Gravitational Force can be derived from the static graviton flux between two stationary objects [7].

Like photon emitted from a heat source by absorbing thermal energy to overcome the string force, graviton can also be emitted from an object by absorbing thermal energy to overcome the gravitational force. In case that both parent object and target object are stationary, it is obvious that Static Graviton Flux (i_s), the gravitons emitted from parent object to stationary target object per unit area per unit time, should be proportional to the mass of the parent object (m_1), and inversely proportional to the square of the distance (r) between parent object and stationary target object (Fig.3). Therefore,

$$i_s = p m_1 / r^2$$

$$\mathbf{i}_s = p m_1 / r^2 \mathbf{r}$$

Where $\mathbf{i}_s$ is the static graviton flux vector and i_s is the static graviton flux emitted from parent object to stationary target object observed at stationary target object, p is static graviton flux constant, m_1 is the mass of parent object, r is the distance from m_1 and $\mathbf{r}$ is the unit vector with direction from parent object m_1 to stationary target object m_2 .

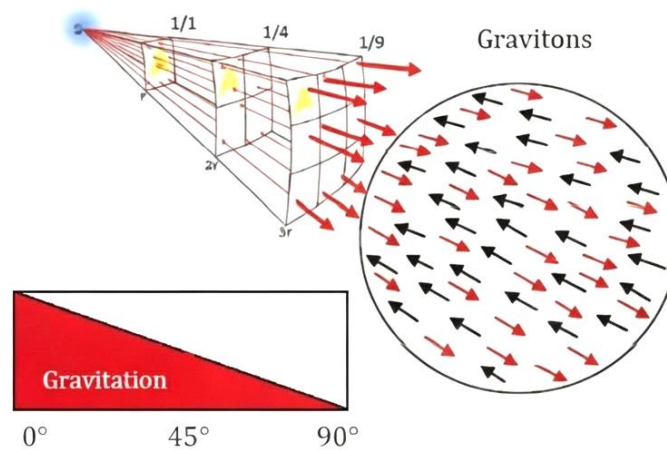


Fig. 3 Gravitational force caused by Graviton Radiation and Contact Interaction.

As a consequence, the static remote gravitational force (F_s) generated by contact interaction between the gravitons emitted from the parent object and the gravitons on the stationary target object should be proportional to the static graviton flux (i_s) arriving at the stationary target object and the total quantity of the gravitons on the stationary target object which is proportional to the mass of the stationary target object (m_2) (Fig. 3). Therefore,

$$F_s = q m_2 (p m_1 / r^2)$$

Given

$$G = pq$$

Then

$$F_s = G m_1 m_2 / r^2$$

$$\mathbf{F}_s = G (m_1 m_2 / r^2) \mathbf{S}$$

Where F_s is the static remote gravitational force and $\mathbf{F}_s$ is the static remote gravitational force vector applied on stationary target object by the gravitons emitted from parent object observed at stationary target object, q is graviton contact interaction constant, p is static graviton flux constant, m_1 is the mass of parent object and m_2 is the mass of stationary target object, r is the distance between parent object m_1 and stationary target object m_2 and $\mathbf{S}$ is the unit vector with direction from stationary target object m_2 to parent object m_1 .

In addition, because of the random angles from 0° to 90° between the emitted gravitons from the parent object and the gravitons on the target (Fig. 3), an average 50% of the full contact interactions should be expected³

As illustrated in Fig. 4 Newton's Universal Gravitation as the static remote gravitational force can be represented as follows:

$$\mathbf{F} = G (m_1 m_2 / r^2) \mathbf{S}$$

Where $\mathbf{F}$ is Newton's Universal Gravitation vector (static remote gravitational force vector) applied on stationary target object by the gravitons emitted from parent object. G is Gravitational Constant (a Universal Physical Constant independent of gravitational field and aging of the universe, $G = 6.674 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$ measured on earth with earth number and units), m_1 is the mass of parent object and m_2 is the mass of stationary target object, r is the distance between parent object m_1 and stationary target object m_2 and $\mathbf{S}$ is the unit vector with direction from stationary target object m_2 to parent object m_1 . This equation is called "Newton's Law of Universal Gravitation".

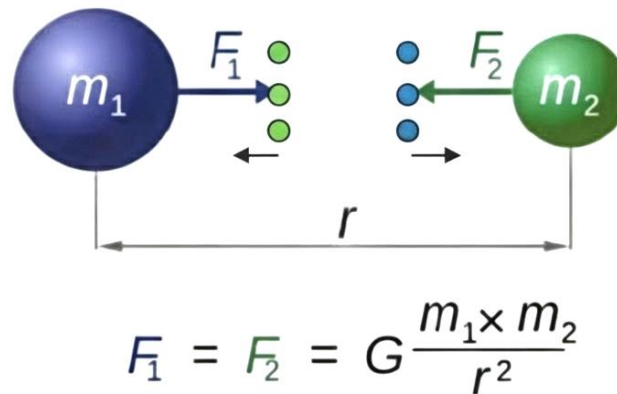


Fig. 4 Newton's Universal Gravitation (remote gravitational force) between two objects.

Also vice versa, the same Newton's universal gravitational force except in the opposite direction can be applied to the parent object by the gravitons emitted from the stationary target object.

$$\mathbf{F}' = G (m_1 m_2 / r^2) \mathbf{S}'$$

Where $\mathbf{F}'$ is Newton's Universal Gravitation vector (static remote gravitational force vector) applied on parent object by the gravitons emitted from the stationary target object observed at parent object (also at the stationary target object), G is gravitational constant, m_1 is the mass of parent object and m_2 is the mass of stationary target object, r is the distance between parent object m_1 and stationary target object m_2 and $\mathbf{S}'$ is the unit vector with direction from parent object m_1 to stationary target object m_2 .

VI. Gravitational Constant

Gravitational Constant G is a universal physical constant which is a true constant physical quantity independent of local gravitational field and aging of the universe. However, it contains a variable real number and a group of variable unit physical quantities which are dependent on the local gravitational field and aging of the universe at the location and time of the measurement (reference point and time) [15].

Even measured at the same location and time, Gravitational Constant can vary with the distribution of mass in both parent and target objects. Also, it can be affected by the speed of dynamic graviton flux (such as anisotropic light speed), target shape (such as cross projection area in pendulum swing) and effective mass (such as blocking black holes in LIGO). In other words, Gravitational Constant can change with the total actual remote gravitational force caused by the graviton bombardment through graviton flux based on Graviton Radiation and Contact Interaction Theory. Because of these reasons, the measurement of the actual Gravitational Constant G becomes extremely difficult.

VII. Dynamic Graviton Flux and Dynamic Remote Gravitational Force

Like any other flux, in addition to the concentration of graviton, graviton flux is also proportional to graviton speed. Therefore, both static and dynamic graviton fluxes and vectors can be represented as follows:

$$i_s = kV_s (m_1/r^2)$$

$$\mathbf{i}_s = k\mathbf{V}_s (m_1/r^2)$$

$$kV_s = kC = p$$

$$G = pq$$

$$k = G/qC$$

And

$$i_d = kV_d (m_1/r^2)$$

$$i_d = kV_d (m_1/r^2)$$

Where k is graviton flux constant, i_s is static graviton flux and V_s is static graviton flux speed observed at stationary target, i_s is static graviton flux vector and V_s is static graviton flux speed vector observed at stationary target. Also, i_d is dynamic graviton flux and V_d is dynamic graviton flux speed observed at moving target object, i_d is dynamic graviton flux vector and V_d (equal to tV_g) is dynamic graviton flux speed vector observed at moving target object. m_1 is the mass of parent object and r is the distance between parent object and target object.

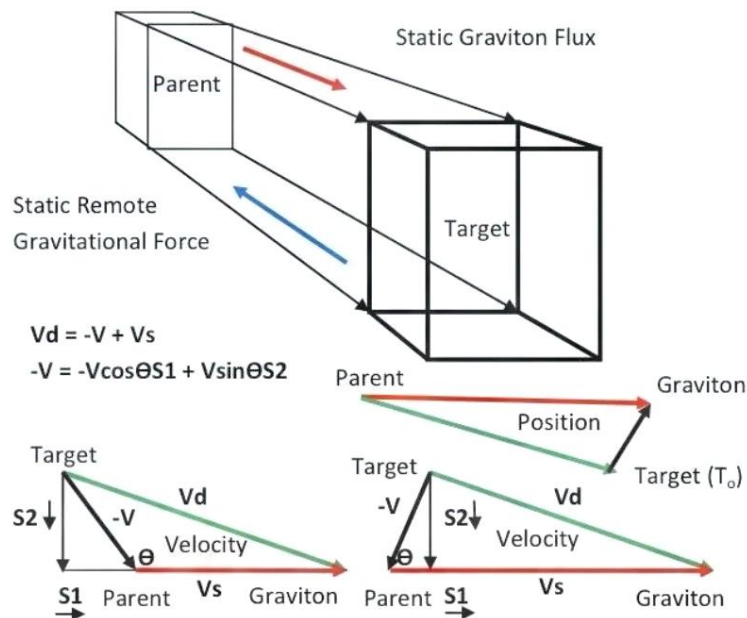


Fig. 5 A schematic diagram of dynamic graviton flux observed at target object interpreted by Equation of Relative Velocity $V_d = -V + V_s$. Where V_d is the speed of dynamic graviton flux observed at target object, V is the speed of target object observed at parent object and V_s is the speed of graviton observed at parent object.

Fig. 5 [16] (revised from [9][10]) shows a schematic diagram of the relative positions and velocities between three objects: graviton, parent object and target object. Take the stationary parent object 'p' (or position P) as reference point. In the beginning at time $t_0 = 0$, graviton 'g' is emitted from the stationary parent object 'p' at position P. Meantime, target object 't' is moving out from its original position T_0 . Finally at time $t_f = t$ both graviton 'g' and target object 't' meet at position G. Therefore,

$$T_0G = T_0P + PG$$

Also, according to Equation of Relative Velocity, at final position G, for constant velocities, the velocity of graviton observed at target object tV_g (equal to V_d moves towards target) is the vector summation of the velocity of parent object observed at target object tV_p (equal to $-V$ and $V = {}^pV_t$, the velocity of target object observed at parent object) and the velocity of graviton observed at parent object pV_g (equal to V_s the velocity of static graviton flux observed at either parent object or target object). Therefore,

$${}^tV_g = {}^tV_p + {}^pV_g$$

And

$$V_d = -V + V_s$$

Also,

$$\mathbf{T_oG} = \mathbf{T_oP} + \mathbf{PG}$$

And

$$\mathbf{T_oG}/t = {}_p\mathbf{V}_t = -{}_t\mathbf{V}_p = \mathbf{V}$$

$$\mathbf{PT_o}/t = {}_t\mathbf{V}_g = \mathbf{V_d}$$

$$\mathbf{PG}/t = {}_p\mathbf{V}_g = \mathbf{V_s}$$

As shown in Fig. 5 because the triangle of Equation of Position composed of $\mathbf{PT_o}$, $\mathbf{T_oG}$ and $\mathbf{PG}$ is proportional to the triangle of Equation of Relative Velocity composed of $\mathbf{V_d}$, $\mathbf{V}$ and $\mathbf{V_s}$, therefore the angle between $\mathbf{T_oG}$ and $\mathbf{PG}$ is equal to that between $-\mathbf{V}$ and $\mathbf{V_s}$, also as is the angle Θ between the velocity of target object $\mathbf{V}$ and the velocity of static graviton flux $\mathbf{V_s}$ observed at parent object (Fig. 5) shows that in both $\Theta < 90^\circ$ and $\Theta > 90^\circ$ cases). As a result, $\mathbf{V_d}$ is parallel to $\mathbf{PT_o}$ and can be calculated as follows:

Because

$$\mathbf{V_d} = -\mathbf{V} + \mathbf{V_s}$$

And

$$-\mathbf{V} = -V \cos\Theta \mathbf{S_1} + V \sin\Theta \mathbf{S_2}$$

Assuming graviton speed is equal to light speed C , then

$$\mathbf{V_s} = C\mathbf{S_1}$$

Therefore,

$$\mathbf{V_d} = (C - V \cos\Theta) \mathbf{S_1} + V \sin\Theta \mathbf{S_2}$$

$$V_d = [(C - V \cos\Theta)^2 + (V \sin\Theta)^2]^{1/2}$$

Where V_d is the velocity of dynamic graviton flux observed at target object and $\mathbf{V_d}$ is the vector of velocity of dynamic graviton flux observed at target object. C is light speed, V is the speed of target object observed at parent object, and Θ is the angle between the velocity of target object $\mathbf{V}$ and the velocity of static graviton flux $\mathbf{V_s}$ observed at parent object. Also, $\mathbf{S_1}$ is the unit vector along static graviton flux $\mathbf{V_s}$ and $\mathbf{S_2}$ is the unit vector perpendicular to static graviton flux $\mathbf{V_s}$ towards target object.

Because dynamic graviton flux and dynamic graviton flux vector can be represented as follows:

$$\mathbf{i_d} = k\mathbf{V_d} (m_1/r^2)$$

$$i_d = kV_d (m_1/r^2)$$

Therefore,

$$\mathbf{i_d} = k [(C - V \cos\Theta) \mathbf{S_1} + V \sin\Theta \mathbf{S_2}] (m_1/r^2)$$

$$i_d = k [(C - V \cos\Theta)^2 + (V \sin\Theta)^2]^{1/2} (m_1/r^2)$$

Where $\mathbf{i_d}$ is the vector of dynamic graviton flux, i_d is dynamic graviton flux, k is graviton flux constant, C is light speed, V is the velocity of target object and Θ is the angle between the velocity of target object $\mathbf{V}$ and the velocity of static graviton flux $\mathbf{V_s}$ observed at parent object. Also, $\mathbf{S_1}$ is the unit vector along static graviton flux $\mathbf{V_s}$ and $\mathbf{S_2}$ is the unit vector perpendicular to static graviton flux $\mathbf{V_s}$ towards target object. m_1 is the mass of parent object, r is the distance between two objects.

Furthermore,

$$p = kC$$

$$pq = G$$

$$qk = G/C$$

Where k is graviton flux constant, p is static graviton flux constant, q is graviton contact interaction constant. C is light speed (graviton flux speed) and G is gravitational constant.

Because

$$\mathbf{i}_d = kV_d (m_1/r^2)$$

$$i_d = kV_d (m_1/r^2)$$

And

$$\mathbf{F}_d = - qm_2 \mathbf{i}_d$$

$$F_d = - qm_2 i_d$$

Therefore,

$$\mathbf{F}_d = - qkV_d (m_1m_2/r^2)$$

$$F_d = - qkV_d (m_1m_2/r^2)$$

Also,

$$\mathbf{F}_d = - (G/C) [(C - V \cos\Theta) \mathbf{S}_1 + V \sin\Theta \mathbf{S}_2] (m_1m_2/r^2)$$

$$F_d = (G/C) [(C - V \cos\Theta)^2 + (V \sin\Theta)^2]^{1/2} (m_1m_2/r^2)$$

Where $\mathbf{F}_d$ is the vector of dynamic remote gravitational force and F_d is dynamic remote gravitational force, G is gravitational constant, C is light speed, V is the speed of target object observed at parent object, Θ is the angle between the velocity of target object $\mathbf{V}$ and the velocity of static graviton flux $\mathbf{V}_s$ observed at parent object, $\mathbf{S}_1$ is the unit vector along static graviton flux $\mathbf{V}_s$ and $\mathbf{S}_2$ is the unit vector perpendicular to static graviton flux $\mathbf{V}_s$ towards target object, m_1 is the mass of parent object, m_2 is the mass of target object, r is the distance between two objects.

Dynamic remote gravitational force is dependent on the speed of dynamic graviton flux observed at target object, which is further dependent on the speed of target object and the angle between the velocity of target object and the velocity of static graviton flux observed at parent object. Also, according to Wu's Spacetime Shrinkage Theory, all the properties of a moving target object are dependent on the dynamic remote gravitational force. As a result, all the properties of a moving target object are dependent on the speed and direct of the moving target object with respect to the parent object. Therefore, when a photon passes through a massive object, anisotropic light speeds can be produced at different directions.

VIII. Gravitational Field

Gravitational field is defined as the total remote gravitational forces generated by all the parent objects in the universe onto a unit mass (1kg) target object.

Therefore, for a single parent object and 1kg target object, the static gravitational field F_{gs} (also noted as F_g) and its vector $\mathbf{F}_{gs}$ (also noted as $\mathbf{F}_g$) can be represented as follows:

$$F_{gs} = F_g = 1\text{kg } G (M/r^2)$$

$$\mathbf{F}_{gs} = \mathbf{F}_g = 1\text{kg } G (M/r^2) \mathbf{S}$$

Also, for a single parent object and 1kg target object, the dynamic gravitational field F_{gd} and its vector $\mathbf{F}_{gd}$ can be represented as follows:

$$F_{gd} = 1\text{kg } (G/C)[(C - V \cos\Theta)^2 + (V \sin\Theta)^2]^{1/2} (M/r^2)$$

$$\mathbf{F}_{gd} = - 1\text{kg } (G/C)[(C - V \cos\Theta) \mathbf{S}_1 + V \sin\Theta \mathbf{S}_2] (M/r^2)$$

As a result, for a single parent object and 1kg target object, the intensity of dynamic gravitational field F_{gd} can vary with the relative moving velocities and directions of target object. For example,

If $V = 0$ (static graviton flux), then $F_{gd} = F_{gs} = F_g = 1\text{kg } G(M/r^2)$

If $\Theta = 0^\circ$, then $F_{gd} = 1\text{kg } G (1-V/C) (M/r^2)$

If $\Theta = 90^\circ$, then $F_{gd} = 1\text{kg } G (1 + V^2/C^2)^{1/2} (M/r^2)$

If $\Theta = 180^\circ$, then $F_{gd} = 1\text{kg } G (1+V/C) (M/r^2)$

Also, for a multiple parent object system, the total gravitational field vector can be represented as follows:

$$\mathbf{F}_{gT} = \sum \mathbf{F}_{gs} + \sum \mathbf{F}_{gd}$$

$$\mathbf{F}_{gT} = - \{ \sum 1\text{kg } G (M/r^2) \mathbf{S} + \sum 1\text{kg } (G/C)[(C - V \cos\Theta) \mathbf{S}_1 + V \sin\Theta \mathbf{S}_2] (M/r^2) \}$$

Furthermore, according to Wu's Spacetime Shrinkage Theory, the total intensity of all gravitational fields ($Q_g = \sum F_{gs} + \sum F_{gd}$) can affect Wu Unit Length and Wu Unit Time of the subatomic particles in an object or event and subsequently changes all the properties of the object or event.

IX. Graviton Bombardment

According to Gravity Affected Wu's Spacetime Shrinkage Theory [17], all Wu Unit Length and Wu Unit Time of Wu's Pairs in the subatomic particles of an object or event become bigger at massive gravitational field. Here the gravitational field means the total intensities of all gravitational fields ($\sum F_{gs} + \sum F_{gd}$) applied on a unit mass of 1kg. It is different from the intensity of the vector of total gravitational field (F_{gT}) applied on a unit mass 1kg. Thus, it is more accurate to use Graviton Bombardment Strength Q_g instead of gravitational field as the total intensity of all gravitational fields on a unit mass 1kg.

Since the total intensities of all gravitational fields are the total intensities of all remote gravitational forces applied on a unit mass 1kg by Graviton Radiation and Contact Interaction, which are caused by the total intensities of all graviton fluxes applied on a unit mass 1kg, therefore graviton bombardment strength as the total intensities of all gravitational fields is proportional to the total intensities of all graviton fluxes applied on a unit mass 1kg.

$$Q_g = \sum F_{gs} + \sum F_{gd} = 1\text{kg } q (\sum i_s + \sum i_d)$$

$$Q_g \propto (\sum i_s + \sum i_d)$$

Where Q_g is graviton bombardment strength.

Subsequently, based on Wu's Spacetime Transformation Theory [18] (in accordance with Principle of Parallelism [19] and Wu's Spacetime Equation [17]), when Wu Unit Length and Wu Unit Time of the subatomic particles in an object or event become bigger due to massive graviton bombardment strength (gravitational field), the dimension and duration of the object or event are bigger, also wavelength is larger, light speed is smaller and clock runs slower.

As a result, Graviton Bombardment Strength is a dominant factor to Wu Unit Length and Wu Unit Time of the subatomic particles in an object or event, which can affect the properties of the object or event. This successfully

interprets many cosmological phenomena such as Gravitational Redshift, Deflection of Light, Perihelion Precession of Mercury and Time Dilation.

X. Wu's Spacetime Shrinkage Theory

According to Yangton and Yington Theory, Wu's Pairs are the building blocks of the universe. Therefore, with the same atomic and subatomic structures under the same thermal equilibrium, Wu Unit Length l_{yy} (dimension) and Wu Unit Time t_{yy} (duration) are the dominant factors of all the properties of an object or event. In other words, any interference that can affect either Wu Unit Length or Wu Unit Time can also change the properties of the object or event.

It is proposed that under the same thermal equilibrium, at large gravitational field or in early aging of the universe, Wu Unit Length and Wu Unit Time of Wu's Pairs in the elementary subatomic particle of an object or event is bigger than that in the corresponding identical elementary subatomic particle of the corresponding identical object or event at small gravitational field or in late aging of the universe. This is called "Wu's Spacetime Shrinkage Theory" [17].

More specifically, under the same thermal equilibrium, at large gravitational field, due to the massive graviton bombardment, the circulation speed of Wu's Pairs V is slower, therefore Wu Unit Length l_{yy} ($l_{yy} = 2R$ and Wu's Pair Circulation Equation $V^2R = K$) [17] and Wu Unit Time t_{yy} (Wu's Spacetime Equation $t_{yy} = \gamma l_{yy}^{3/2}$) [17] of Wu's Pairs in the elementary subatomic particle of an object or event are bigger than that in the same (corresponding identical) elementary subatomic particle of the same (corresponding identical) object or event at small gravitational field. This is called "Gravity Affected Wu's Spacetime Shrinkage Theory" [17].

On the other hand, under the same thermal equilibrium, in late aging of the universe, due to the attraction caused by Force of Creation in Wu's Pairs, the circulation speed of Wu's Pairs V is faster, therefore Wu Unit Length and Wu Unit Time of Wu's Pairs in the elementary subatomic particles of an object or event are smaller than that in the same (corresponding identical) elementary subatomic particle of the same (corresponding identical) object or event in early aging of the universe. This is called "Aging Affected Wu's Spacetime Shrinkage Theory" [17].

Furthermore, based on Wu's Spacetime Shrinkage Theory and Wu's Spacetime Transformation (in accordance with Principle of Parallelism and Wu's Spacetime Equation), under the same thermal equilibrium, an object or event has bigger dimension and duration, and smaller velocity and acceleration, also a photon has larger wavelength and smaller light speed, at large gravitational field and in early aging of the universe, than that at small gravitational field and in late aging of the universe.

As a result, Wu's Spacetime Shrinkage Theory and Wu's Spacetime Transformation can be applied to explain many important physical phenomena such as Altitude Time Dilation [20], Air Bound Flight Time Dilation [21], Pendulum Swing Time Dilation [14], Gravitational Redshift [11], Cosmological Redshift [17], Gravitational Time Dilation [22], Hubble's Law [23], Intrinsic Expansion [24], Universe Reverse Expansion [25][26], Deflection of Light [27], Anisotropic Light Speed [16], Gravitational Wave [27] and Perihelion Precession of Mercury [28], Einstein's General Relativity [29], Spacetime [29] and Field Equations [30].

XI. Pendulum Swing Time Dilation and Dynamic Graviton Flux

Time dilation can be produced by the variation of static gravitational field which is proportional to the mass of target object (m_2) and the intensity of static graviton flux (m_1/r^2) from parent object, such as the pendulum clock at high altitude. Time dilation can also be generated by the change of dynamic gravitational field which is proportional to the mass of target object (m_2) and the intensity of dynamic graviton flux (Vm_1/r^2) dependent on the relative motion between target object and parent object, such as the atomic clock in air bound flight.

According to Gravity Affected Wu's Spacetime Shrinkage Theory, under thermal equilibrium, Wu Unit Length (diameter) and Wu Unit Time (period) of Wu's Pairs in all subatomic particles of an object or event at massive gravitational field (more precisely graviton bombardment), are bigger than that at small gravitational field. In addition, based on Wu's Spacetime Transformation (in accordance with Principle of Parallelism and Wu's Spacetime Equation), while Wu Unit Time and Wu Unit Length are bigger, the dimension and duration of the object or event are larger, velocity and acceleration are smaller, also wavelength is bigger and light speed of a

photon is slower. As a result, larger gravitational field (graviton bombardment) can cause bigger time dilation (larger duration).

On the other hand, the shape of the target object can also affect the total intensity of graviton bombardment [14]. For a fixed mass target object, bigger projection cross area can receive more graviton flux, and thus more graviton bombardment and bigger time dilation. Therefore, a target object shape factor R proportional to the target projection cross area should be incorporated into the calculation of both static remote gravitational force and dynamic remote gravitational force as follows:

$$F_s = -R(qkV_s(m_1m_2/r^2))$$

$$F_d = -R(qkV_d(m_1m_2/r^2))$$

And

$$p = kC$$

$$pq = G$$

$$qk = G/C$$

Where k is graviton flux constant, p is static graviton flux constant, q is graviton contact interaction constant.

Therefore,

$$F_s = -R((G/C)V_s(m_1m_2/r^2))$$

$$F_d = -R((G/C)V_d(m_1m_2/r^2))$$

Where F_s is static remote gravitational force vector, V_s is static graviton flux velocity vector, F_d is dynamic remote gravitational force vector, V_d is dynamic graviton flux velocity vector, G is gravitational constant, C is Absolute Light Speed, m_1 is the mass of parent object, m_2 is the mass of target object, r is the distance between two objects and R is the shape factor of target object (R increases with the projection cross area for short distance target object and R is 1 for long distance target object).

Recently Giorgio Toro did an experiment on a pendulum clock made of different metals and found out that the fixed mass pendulums at 90° to the swing plane had slower clock rates than those parallel to the swing plane [14]. In his experiment, because pendulum is a moving target object and earth is a stationary parent object, therefore dynamic remote gravitational force vector F_d and dynamic graviton flux velocity vector V_d can be generated as follows:

$$F_d = -R((G/C)V_d(m_1m_2/r^2))$$

$$V_d = {}_pV_g = {}_eV_g - {}_eV_p$$

Where according to Equation of Relative Velocity, ${}_pV_g$ is the velocity of graviton observed at pendulum, ${}_eV_g$ is the velocity of graviton observed on earth and ${}_eV_p$ is the velocity of pendulum observed on earth.

Fig. 6 shows the comparison of a fixed mass pendulum with fixed length and amplitude between those swings at 90° to the swing plane and in parallel to the swing plane. In both cases the mass of the pendulums (m_2) and earth (m_1), and the distance between the pendulums and earth (r) are the same. Also, the speed and direction of the pendulums at any corresponding position in both cases are the same, as is the dynamic graviton flux velocity (V_d). Furthermore, the projection cross areas between the pendulums and gravitational flux of earth (shape factor) are the same (revised from [21] [31]). Therefore, the dynamic remote gravitational forces in both cases at any corresponding position remain always the same.

As a result, according to Gravity Affected Wu's Spacetime Shrinkage Theory and Wu's Spacetime Transformation, under equal remote gravitational force (graviton bombardment strength), Wu Unit Time is equal, same as the period of the pendulum clock, and there is no Gravitational Time Dilation between those pendulum

swings at 90° to the swing plane and in parallel to the swing plane. This result was confirmed with Giorgio Toro through a private communication (May 2025 message from Academia.edu). He admitted that there was an experimental error in his previous experiment [14] and the conclusion that pendulum swings at 90° to the swing plane has a bigger time dilation is incorrect [14].

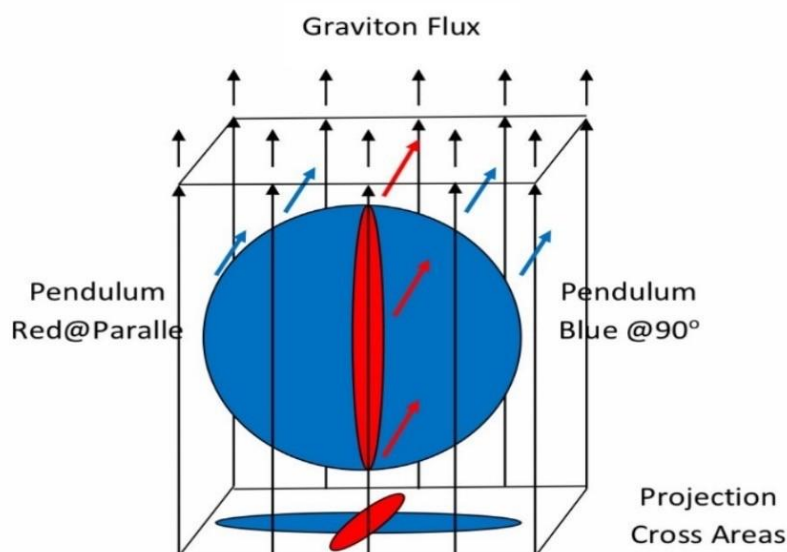


Fig. 6 Dynamic graviton flux and dynamic remote gravitational force generated by a swing pendulum increase with the projection cross area between the swing pendulum and graviton flux. The dynamic remote gravitational force is bigger @ 90° than that @ parallel, as is the time dilation.

In conclusion, Giorgio Toro's swing pendulum experiment can be very well explained by the shape factor of target object and dynamic graviton flux. It has nothing to do with the inertia of Aether (Aether Flow or static graviton flux) and Aether wind (relative moving direction between target and parent objects).

XII. Conclusion

According to Yangton and Yington Theory, gravitational time dilation is caused by the variation of Wu Unit Time (circulation period of Wu's Pairs) due to the different remote gravitational forces generated by graviton fluxes based on Graviton Radiation and Contact Interaction Theory. In case of static graviton flux (stationary target), the strength of the remote gravitational force is dependent on the shape, mass and distance of the target object, as is Newton's Universal Gravitation. In case of dynamic graviton flux (moving target), it is further dependent on the relative moving speed and direction between the target and parent objects.

Recently, Giorgio Toro did a pendulum swing experiment with various arrangements. The pendulums have a fixed mass at the same distance from earth, also the same speed and moving angel at all corresponding positions, as well as the same cross projection area (same shape factor) under the gravitational force on earth, in other words, the pendulums have the same dynamic remote gravitational force at all corresponding positions, therefore, a fixed mass pendulum swinging at 90° to the swing plane must have the same running rate as that swinging in parallel to the swing plane. Thus, no Gravitational Time Dilation should be detected. This opposes Giorgio Toro's original claims to his incorrect experiments and the wrong analyses in my previous publications.

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