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Redshift Caused by Acceleration Doppler Effect and Hubble's Law Based on Wu's Spacetime Accelerating Shrinkage Theory

Edward T. H. Wu

Solar Buster Corporation, Los Angeles, USA

Email address:
edwardthwu@yahoo.com

Abstract: Acceleration Doppler Effect is introduced to explain the Redshift phenomenon in Inertia Transformation process. Hubble's Law and Cosmological Redshift are interpreted by Wu's Spacetime Accelerating Shrinkage Theory. In addition, Wu's Laws of Spacetime of Wu's Pair and Photon with respect to the age of universe and the gravitational field are derived and summarized.

Keywords: Yangton, Yington, Wu's Pair, Photon, Acceleration Doppler Effect, Cosmological Redshift, Hubble's Law, Universe Expansion, Spacetime Shrinkage

1. Introduction

Like most Scientists, I first thought that Redshift [1] and Doppler Effect [2] can only exist in the Non-Inertia Transformation process [3] as that in sound propagation. Because of this reason, I claimed that "Photon emitted from the light source travels in vacuum space at an Absolute Light Speed 3 x 10^{8} m/s observed at the light origin in Absolute Space System without any influence from the light source" in my previous publication [3]. But, this conflicts to my logical thinking. It is hard to believe that "A ball throw out of a train will not follow the train". The concept that photon emission is a Non-Inertia Transformation kept on bothering me for a long time until the "Acceleration Doppler Effect" is developed with Inertia Transformation to solve the problem. In addition, I have developed Wu's Spacetime, Spacetime Shrinkage and Spacetime Accelerating Shrinkage Theories [4] to explain Gravitational Redshift and Cosmological Redshift phenomena [5]. As a consequence, Wu's Accelerating Spacetime Shrinkage Theory can be used successfully to explain Hubble's Law [6]. All of the above issues will be discussed in details in this paper.

2. Photon Emission

According to Yangton and Yington Theory [7], photon is generated through a two stage Separation and Ejection process to release Wu's Pair from its parent substance (Figure 1) [8].

A. Separation Stage – Wu's pair is unlocked from its lock-in position at the end of a string structure (parent substance).

B. Ejection Stage – The unlocked Wu's Pair is ejected by the repulsive force between the two Yangton and two Yington particles at the end of the string structure (Figure 1).
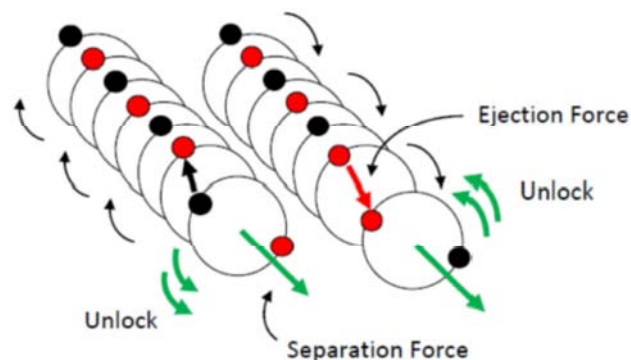

Figure 1. Photon Formed in a two stage process by releasing Wu's Pair from its Parent Substance.

2.1. Absolute Light Speed

Because of the same ejection force, regardless to the frequency, the speed of a photon escaped from its parent source should always have a constant speed 3 x 10^8 m/s (Absolute Light Speed) in the ejection direction observed at light source.

2.2. Inertia Transformation

Photon emitted from the separation and ejection process carries the inertia of the light source. In other words, a photon, emitted from a light source to a vacuum space, travels not only at the Absolute Light Speed 3 x 10^8 m/s in its ejection direction, but also it is dragged to the same direction at the same speed as that of the light source when observed at light origin in Absolute Space System. This phenomenon is named as "Inertia Transformation".

3. Vision of Light

The vision of a photon observed by an observer can be constructed by superimposing observer's position in each time frame onto observer's final position in Absolute Space System. This vision of photon is named as "Vision of Light" [3]. Figure 2 shows the schematic diagrams of the Visions of Light of an emitted photon with respect to the observers at light origin, ground and light source in Absolute Space System, where ground and light source are drifted apart from light origin due to the motions of Earth (V_E) and light source (V_C). After a time interval Δt, assuming all motions are at constant speeds, the Visions of Light of those observers can be represented by the following straight lines: AP–the Vision of Light observed by the observer at light origin (black line), BP–the Vision of Light observed by the observer at ground (red line) and CP–the Vision of Light observed by the observer at light source (green line) respectively. They are all ended at the final position of the emitted photon (point P).
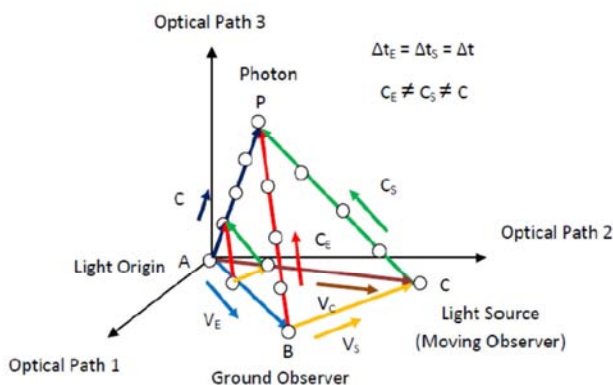

Figure 2. Visions of Light of an emitted photon observed by observers at light origin (black line), ground (red line) and light source (green line) in Absolute Space System.

As a result of Inertia Transformation, CP–the Vision of Light observed by the observer at light source has a constant light speed 3 x 10^8 m/s (C_S) in its ejection direction. AP–the Vision of Light observed by the observer at light origin is the actual trace of the emitted photon in Absolute Space System which is the vector summation of AC–the motion of light source and CP–the Vision of Light observed by the observer at light source. Also, C_O–light speed observed at light origin is the vector summation of C_S– the light speed observed at light source (3 x 10^8 m/s) and V_C – the moving speed of light source.

$$AP = AC + CP$$

$$\mathbf{C}_O = \mathbf{C}_S + \mathbf{V}_C$$

Because the speed of light is calculated by the Vision of Light divided by the traveling time of light, and the traveling time is the same for all observers, therefore the light speed observed by each observer is proportional to the length of the corresponding Vision of Light.

4. Acceleration Doppler Effect

Since the observer always stays in stationary to the light origins of all photons emitted from the light source, the Vision of Light of each photon observed by observer is the same as that observed at the light origin of the photon in the Absolute Space System.

Light source (star) can either move toward or away from the observer. V_o is the speed of the light source at beginning, V_t is the speed of the light source at time t when photon reaches Earth and a is the constant acceleration of the light source. S_t is the distance of the light source traveling from the light origin in time t, P_t is the distance of the photon traveling in the ejection direction from the light origin in time t, $V_o t$ is the distance of the photon dragged by the light source in time t and D_t is the distance between the photon and the light source at time t. And λ_1 is the wavelength, ν_1 is the frequency and C_1 is the light speed observed by the observer on Earth. Zeroshift, Blueshift and Redshift phenomena resulted from Acceleration Doppler Effect can thus be derived by mathematics as follows:

4.1. Zeroshift

When the light source (star) either moves toward or away from the observer at a constant speed ($V_o = V_t$ and a = 0), Zeroshift can be detected.

In case the light source (star) moves away from the observer,

$$S_t = V_o t$$

$$P_t = Ct - V_o t$$

$$D_t = S_t + P_t = Ct$$

Therefore,

$$\lambda_1 = D_t/ft = Ct/ft = C/f = \lambda$$

$$C_1 = P_t/t = (Ct - V_o t)/t = C - V_o < C$$

$$\nu_1 = C_1/\lambda_1 = (C - V_o)/\lambda < \nu$$

When the light source (star) moves away from the observer at a constant speed, the wavelength maintains unchanged, but both frequency and light speed become smaller. However, since $V_o \ll C$, $C_1 \approx C$ and $\nu_1 \approx \nu$. Zeroshift can be detected.

In case the light source (star) moves toward the observer,

$$S_t = -V_o t$$

$$P_t = Ct + V_o t$$

$$D_t = S_t + P_t = Ct$$

Therefore,

$$\lambda_1 = D_t/ft = Ct/ft = C/f = \lambda$$

$$C_1 = P_t/t = (Ct + V_o t)/t = C + V_o > C$$

$$\nu_1 = C_1/\lambda_1 = (C + V_o)/\lambda > \nu$$

When the light source (star) moves toward the observer at a constant speed, the wavelength maintains unchanged, but both frequency and light speed become bigger. However, since $V_o \ll C$, $C_1 \approx C$ and $\nu_1 \approx \nu$. Zeroshift can be detected.

4.2. Blueshift

In case the light source (star) moving toward the observer at a constant acceleration speed,

$$S_t = -(V_o t + \tfrac{1}{2} at)$$

$$P_t = Ct + V_o t$$

$$D_t = S_t + P_t = Ct - \tfrac{1}{2} at$$

Therefore,

$$\lambda_1 = D_t/ft = (Ct - \tfrac{1}{2} at)/ft = (C - \tfrac{1}{2} a)/f < \lambda$$

$$C_1 = P_t/t = (Ct + V_o t)/t = C + V_o > C$$

$$\nu_1 = C_1/\lambda_1 = (C + V_o)/((C - \tfrac{1}{2} a)/f) > \nu$$

When the light source (star) moves toward the observer at a constant acceleration speed, the wavelength becomes smaller, both the frequency and light speed become bigger, and thus Blueshift can be detected.

4.3. Redshift

In case the light source (star) moving away from the observer at a constant acceleration speed,

$$S_t = V_o t + \tfrac{1}{2} at$$

$$P_t = Ct - V_o t$$

$$D_t = S_t + P_t = Ct + \tfrac{1}{2} at$$

Therefore,

$$\lambda_1 = D_t/ft = (Ct + \tfrac{1}{2} at)/ft = (C + \tfrac{1}{2} a)/f > \lambda$$

$$C_1 = P_t/t = (Ct - V_o t)/t = C - V_o < C$$

$$\nu_1 = C_1/\lambda_1 = (C - V_o)/((C + \tfrac{1}{2} a)/f) < \nu$$

When the light source (star) moves away from the observer at constant acceleration speed, the wavelength becomes bigger, both the frequency and light speed become smaller, and thus Redshift can be detected.

5. Redshifts

According to the Acceleration Doppler Effect, Redshift occurs whenever a light source moves away from the observer at an acceleration speed. However, there are another two Redshifts in the universe. Gravitational Redshift is caused by the massive gravitational field and Cosmological Redshift is induced by the shrinkage and acceleration of the Spacetime [4].

6. Yangton and Yington Circulation

Figure 3 is a schematic picture of Wu's Pair – a Yangton and Yington circulating pair [4]. The central acceleration (a_c) can be derived as follows:

$$a_c = dV/dt = (VdS/r)/dt = V (dS/dt)/r = V^2/r$$

Therefore,

$$F_c \propto a_c \propto V^2/r$$

Because,

$$F_{attraction} \propto 1/(2r)^2$$

$$F_c = F_{attraction}$$

Therefore,

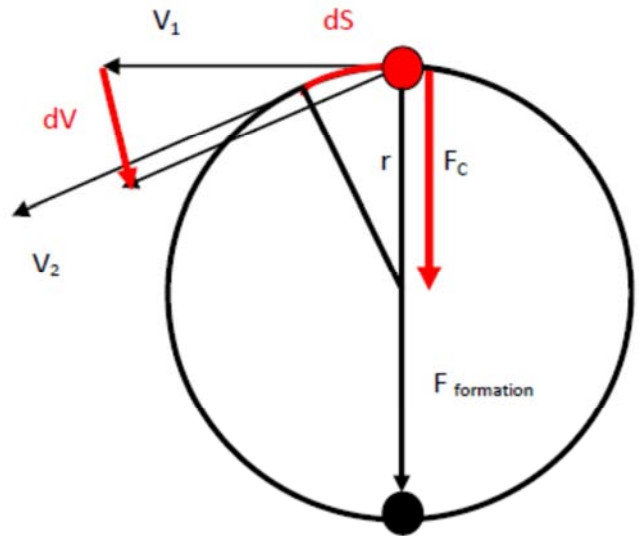$$V^2/r \propto 1/4r^2$$

$$V^2 r = k = constant$$

Figure 3. *Schematic picture of a Wu's Pair.*

7. Spacetime

Spacetime $[t_{yy}, l_{yy}]$ [9] is a four dimensional system [x, y, z, t] based on the Wu's Unit Time (t_{yy}), the period of Wu's Pair, and the Wu's Unit Length (l_{yy}), the size of Wu's Pair, at a reference point in the universe.

7.1. Wu's Spacetime Theory

The circulation period (t_{yy}) and the size (l_{yy}) of the circulation orbit of Wu's Pair are related to each other as follows:

Because,

$$V^2 r = constant$$

And,

$$T = 2\pi r/V$$

$$T^2 = 4\pi^2 r^2/V^2 = 4\pi^2 r^3/V^2 r = 4k_1 \pi^2 r^3$$

$$T = k_2 r^{3/2}$$

Where k_1 and k_2 are constants.

Therefore, "Wu's Spacetime Theory" is represented as follows:

$$t_{yy} = kl_{yy}^{3/2}$$

Where t_{yy} is the circulation period (T) of Wu's Pair named as "Wu's Unit Time", l_{yy} is the size of the circulation orbit (2r) of Wu's Pair named as "Wu's Unit Length", and k is a constant.

7.2. Velocity and Spacetime

Because of "Wu's Spacetime Theory",

$$t_{yy} = kl_{yy}^{3/2}$$

Therefore,

$$l_{yy}/t_{yy} = kl_{yy}^{-1/2}$$

Since velocity is proportional to l_{yy}/t_{yy} [4],

$$V \propto l_{yy}/t_{yy}$$

Therefore,

$$V \propto l_{yy}^{-1/2}$$

7.3. Photon and Spacetime

For a photon moving in vacuum,

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

Also,

$$t_{yy} = kl_{yy}^{3/2}$$

Therefore,

$$\nu \propto l_{yy}^{-3/2}$$

Because,

$$C \propto l_{yy}^{-1/2}$$

And

$$\lambda = C/\nu$$

Therefore,

$$\lambda \propto l_{yy}$$

Where ν is frequency, C is light speed, λ is wave length.

When universe grows older, the circulation speed (V) of Wu's Pair becomes faster. Since $V^2 r$ is always a constant ($V^2 r = k$) for an inter-attractive circulating pair such as Wu's Pair, the size of the circulation orbit (2r) of Wu's Pair becomes smaller. Also, the circulation period (T = 2πr/V) of Wu's Pair is getting smaller. In another word, "Wu's Unit Time" ($t_{yy} = T$) and "Wu's Unit Length ($l_{yy} = 2r$) both become smaller. As a result, when universe grows older, the frequency (ν) of a photon becomes bigger, the light speed (C) becomes faster and the wave length (λ) becomes smaller.

Also, for a high gravitational field, the circulation speed (V) of Wu's Pair becomes slower. Since $V^2 r$ is always a constant ($V^2 r = k$) for an inter-attractive circulating pair such as Wu's Pair, the size of the circulation orbit (2r) of Wu's Pair becomes bigger. Also, the circulation period (T = 2πr/V) of Wu's Pair is getting bigger. In another word, "Wu's Unit Time" ($t_{yy} = T$) and "Wu's Unit Length ($l_{yy} = 2r$) both become bigger. As a result, for a high gravitational field, the frequency (ν) of a photon becomes smaller, the light speed (C) becomes slower and the wave length (λ) becomes bigger.

Photon can be considered as a marker of the Spacetime of the light source. Photon's frequency (ν), light speed (C) and wave length (λ) carry the information of l_{yy} and t_{yy} of the Spacetime of the light source deep into the universe. In other words, photon bears the DNA of the light source.

7.4. Wu's Spacetime Shrinkage Theory

Because of "Wu's Spacetime Theory",

$$t_{yy} = kl_{yy}^{3/2}$$

Therefore,

$$dt_{yy} = k (3/2)l_{yy}^{1/2}dl_{yy}$$

$$dl_{yy}/dt_{yy} = (k (3/2))^{-1}l_{yy}^{-1/2}$$

$$dl_{yy}/dt_{yy} = nl_{yy}^{-1/2}$$

And

$$V_{yy} = nl_{yy}^{-1/2}$$

Where V_{yy} is named as "Spacetime Shrinkage Rate" and n is a constant.

In comparison to those of the ancient universe, the size (l_{yy}) of Wu's Pair of the present Earth is getting smaller ($dl_{yy} < 0$) and the period (t_{yy}) of Wu's Pair is also getting shorter ($dt_{yy} < 0$). The Spacetime Shrinkage Rate (V_{yy}) of Wu's Pair is inversely proportional to the square root of the size of the

circulation orbit of Wu's Pair ($l_{yy}^{-1/2}$). This is named as "Spacetime Shrinkage Theory".

7.5. Wu's Spacetime Accelerating Shrinkage Theory

Because of "Wu's Spacetime Theory",

$$t_{yy} = kl_{yy}^{3/2}$$

Therefore,

$$dt_{yy} = k \, (3/2)l_{yy}^{1/2}dl_{yy}$$

$$V_{yy} = dl_{yy}/dt_{yy} = (k \, (3/2))^{-1}l_{yy}^{-1/2}$$

$$dV_{yy} = (k \, (3/2))^{-1} \, (-1/2)l_{yy}^{-3/2}dl_{yy}$$

$$dV_{yy}/dt_{yy} = -ml_{yy}^{-2}$$

Therefore,

$$a_{yy} = -ml_{yy}^{-2}$$

Where a_{yy} is named as "Spacetime Shrinkage Acceleration Rate" and m is a constant.

In comparison to those of the ancient universe, the size (l_{yy}) of Wu's Pair in the present Earth is getting smaller and the period (t_{yy}) of Wu's Pair is getting shorter. Also the Spacetime Shrinkage Rate of Wu's Pair accelerates at a positive rate ($dV_{yy} > 0$) with respect to the shrinking t_{yy} ($dt_{yy} < 0$) that is inversely proportional to the square of the size of the circulation orbit of Wu's Pair (l_{yy}^{-2}). This is named as "Spacetime Accelerating Shrinkage Theory".

During Spacetime Shrinkage, although t_{yy} and l_{yy} become smaller, the relative amounts of t_w and l_w, t_s and l_s, also t_n and l_n remain unchanged, therefore for light generated on Earth, its speed, frequency and wavelength are always measured the same by the stationary observer on Earth. However, the universe becomes bigger measured by the shrinking l_s on Earth. In addition, because of the Spacetime Accelarating Shrinkage, the light from a star of ancient universe, a few million light years away has lower velocity and lower frequency but longer wavelength observed on Earth which is known as "Cosmological Redshift".

The theory of Accelerating Expansion of Universe requires a lot of external energy that is why scientists have imagined the existence of the mysterious Dark Energy [5] [10] in the universe. Since Dark Energy doesn't exist, also because that the potential energy can be converted to kinetic energy in the shrinking circulation process of Wu's Pair with no need of any external energy, Spacetime Accelerating Shrinkage Theory gives a better explanation to the phenomenon of the expansion and acceleration [10] of the universe.

7.6. Wu's Laws of Spacetime

Table 1 summarizes "Wu's Laws of Spacetime" of Wu's Pair with respect to l_{yy}, t_{yy}, V_{yy} and a_{yy}; and also those of photon with respect to ν, C and λ, in both gravitational field and age of the universe.

Table 1. *Wu's Laws of Spacetime.*

		Young Universe	Aged Universe	High Gravity	Low Gravity
Wu's Pair					
l_{yy} (=2r)	l_{yy} = 2r	Large	Small	Large	Small
t_{yy} (=T)	$t_{yy} \propto l_{yy}^{3/2}$	Large	Small	Large	Small
V	$V \propto l_{yy}^{-1/2}$	Small	Large	Small	Large
V_{yy}	$V_{yy} \propto l_{yy}^{-1/2}$	Small	Large	Small	Large
a_{yy}	$a_{yy} \propto -l_{yy}^{-2}$	Small	Large	Small	Large
Photon					
ν	$\nu = 1/t_{yy} \propto l_{yy}^{-3/2}$	Small	Large	Small	Large
C	$C \propto l_{yy}^{-1/2}$	Small	Large	Small	Large
λ	$\lambda = C/\nu \propto l_{yy}$	Large	Small	Large	Small

8. Hubble's Law Based on Wu's Spacetime Accelerating Shrinkage Theory

The discovery of the linear relationship between Redshift and distance, coupled with a supposed linear relation between recessional velocity and Redshift, yields a straight forward mathematical expression for "Hubble's Law" (Figure 4) [6] as follows:

$$V = H_0 D$$

Where
- V is the recessional velocity, expressed in km/s.
- H_0 is Hubble's constant and corresponds to the value of H (often termed the Hubble parameter which is a value that is time dependent and which can be expressed in terms of the scale factor) in the Friedmann equations taken at the time of observation denoted by the subscript "$_0$". This value is the same throughout the universe for a given comoving time.
- D is the proper distance (which can change over time, unlike the comoving distance, which is constant) from the galaxy to the observer, measured in mega parsecs (Mpc), in the 3-space defined by given cosmological time. (Recession velocity is just V = dD/dt).
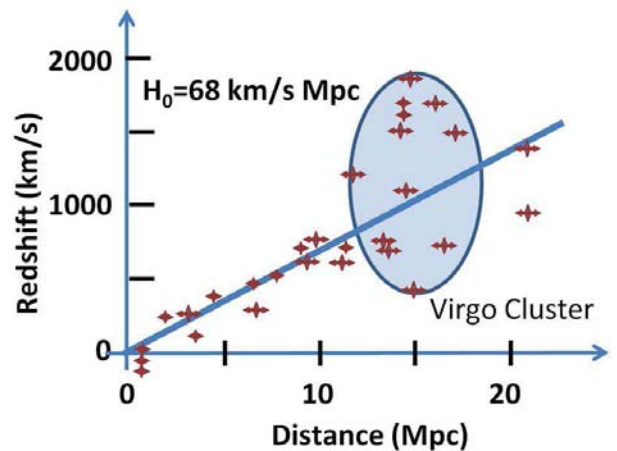

Figure 4. *Hubble's Law – the linear relationship between Redshift and Proper Distance.*

According to Hubble's Law, there is a linear relation between recessional velocity (V) and Redshift $(\lambda - \lambda_0)/\lambda_0$,

$$V \propto (\lambda - \lambda_0)/\lambda_0$$

Where λ_0 is the present wave length on Earth.
And,

$$\lambda \propto l_{yy}$$

Therefore,

$$V \propto (l_{yy} - l_{yy0})/l_{yy0}$$

Where l_{yy0} is the present Wu's Unit Length on Earth.
Also, D is found to be proportional to the Redshift,

$$D \propto (\lambda - \lambda_0)/\lambda_0$$

Therefore,

$$D \propto (l_{yy} - l_{yy0})/l_{yy0}$$

Because both V and D are proportional to $(l_{yy} - l_{yy0})/l_{yy0}$ (named as Spacetime Shrinkage Factor), Hubble's Law goes very well with Wu's Spacetime Accelerating Shrinkage Theory. Therefore, instead of that the universe is expanding and accelerating, Wu's Unit Length (l_{yy}), or in other words, Wu's Spacetime is shrinking and accelerating.

9. Conclusion

Instead of Doppler Effect for Non-Inertia Transformation, Acceleration Doppler Effect is introduced and derived successfully to explain the Redshift phenomenon in Inertia Transformation process. Specitime Shrinkage factor is defined and Hubble's Law and Cosmological Redshift can be interpreted by Wu's Spacetime Accelerating Shrinkage Theory. In addition, Wu's Laws of Spacetime of Wu's Pair with respect to l_{yy}, t_{yy}, V_{yy} and a_{yy}, as well as Wu's Laws of Spacetime of photon with respect to v, C and λ, in both gravitational field and age of universe are derived and summarized.

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