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Axial Doppler Shift, Transverse Doppler Shift and Acceleration Doppler Shift Interpreted and Derived by Equation of Light Speed

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[Abstract]
Despite relativism, Axial Doppler Shift, Transverse Doppler Shift and Acceleration Doppler Shift can be interpreted and derived by Equation of Light Speed $\boldsymbol{C' = C + V}$*, where Normal Light Speed* $\boldsymbol{C'}$ *(light speed observed at the reference point) is a vector summation of Absolute Light Speed* $\boldsymbol{C}$ *(light speed observed at light source 3 x* 10^8 *m/s) and Inertia Light Speed* $\boldsymbol{V}$ *(speed of light source observed at reference point). Absolute Light Speed is dependent on the local gravitational field and aging of the universe. Inertia Light Speed on the other hand is dependent on the relative motion between light source and reference point. As a result, subject to the relative speed and direction between light source and reference point, different types of Optical Doppler Shifts can be interpreted and derived by Equation of Light Speed such as Axial Doppler Shift generated by constant speed of light source in axial direction; Transverse Doppler Shift caused of constant speed of light source in various directions from sight; and Acceleration Doppler Shift resulted from constant acceleration of light source in axial direction.*

[Keywords]
Special Relativity, General Relativity, Relativism, Photon Inertia Transformation, Equation of Light Speed, Doppler Effect, Acceleration Doppler Effect, Axial Doppler Shift, Transverse Doppler Shift, Acceleration Doppler Shift, Wu's Pairs, Yangton and Yington Theory.

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I. Introduction

Einstein's Special Relativity is based on the postulation that "light speed in vacuum is constant no matter the light sources and observers". In other words, light speed observed at any reference point is the same as that observed at a moving light source. Is it true? Scientists have debated this issue for the whole last millennium since it was first proposed by Einstein in 1905. Is there any experimental evidence can prove this assumption? The answer is none so far, simply because it is nearly impossible to measure precision light speed on a light source moving at comparatively fast speed. However, some cosmological phenomena can be used as indirect proofs to those theories regarding if or not that light speed is constant. Relativism as one principle theory based on relativity claiming that "light speed is constant" was used by many physicists trying to explain those cosmological phenomena, yet a little success and has caused a lot of flaws and unsolved paradoxes [1]. On the contrary, Equation of Light Speed as the principle theory claiming that "light speed is not constant" has been used successfully in explanation of many phenomena such as Cosmological Redshift [2], Gravitational Redshift [2], Hubble's Law [3], Universe Expansion [4], Deflection of Light [5] and Event Horizon [6], etc. As a consequence, in this paper, Equation of Light Speed is used again to interpret and derive Axial Doppler Shift, Acceleration Doppler Shift and Transverse Doppler Shift.

II. Photon

According to Yangton and Yington Theory [7], photon is a free Wu's Pair (the building blocks of the universe composed of a pair of super fine Yangton and Yington circulating antimatter particles), traveling in the normal direction of the Yangton and Yington circulation orbit in space at light speed. Therefore the mass of a photon is the same as that of a Wu's Pair (m_{yy}).

Since the circulation orbit is extremely small, any force induced by the Yangton (positive electric unit charge) can be neutralized by its counter force induced by the Yington (negative electric unit charge). In other words, photon doesn't respond to the attractive and repulsive forces caused by gravitational and electromagnetic fields (except the impact mechanical force caused by the bombardment of gravitons). Therefore, photon has zero gravity on the surface of earth and sun, except in an extremely high gravitational field such as in a Black Hole.

III. Electromagnetic Wave

Because of the similarity of the inter-attractive Force of Creation between Yangton and Yington Pairs (Wu's Pairs) and the electrical force between electron and positron, it is assumed that a Yangton carries one positive electric unit charge and a Yington carries one negative electric unit charge. Together they form an electric dipole. These electric unit charges are the basic units of the normal electric charges that are carried by electrons, positrons and protons, except in a much smaller scale. According to Yangton and Yington Theory, once Wu's Pairs are released from a substance, they become photons. Because of the circulation of the Yangton and Yington Pair (the rotation of the electric dipole) on the vertical plane of photon traveling direction, electromagnetic wave can be generated and carried by the photon to a far distance in space [7].

IV. Emission of Photon

When a photon emitted from light source, it undergoes a two stage process: separation stage and ejection stage [8].

A. Separation Stage

According to Yangton and Yington Theory, to unlock a photon from the surface of the light source, it requires thermal energy (kinetic energy) to overcome the string energy caused by the string force between two adjacent Wu's Pairs.

In addition, based on Whirlpool Theory [9], a spinning particle separated from its parent spinning system should have a kinetic energy E that is proportional to the particle mass m and the spin frequency ν.

$E = \kappa m \nu$

Photon is a free Wu's Pair with mass m_{yy}

$E = \kappa m_{yy} \nu$

Where κ is whirlpool constant and m_{yy} is the mass of photon (or Wu's Pair).

Given

$h = \kappa m_{yy}$

Therefore,

$E = h\nu$

Where h is Planck constant.

B. Ejection Stage

After separation from the parent object, photon is ejected toward the normal (axial) direction of Yangton and Yington circulation orbit by the repulsive string forces generated between the two adjacent Yangton particles, also between two adjacent Yington particles, where one from the emitting photon and the other one from Wu's Pair on the surface of the parent object. Because of the constant repulsive string forces, regardless of the frequency, a photon escaped from its parent object (light source) should always have a constant speed 3×10^8 m/s.

V. Inertia Transformation versus Non-inertia Transformation

Photon just like electron or any other particle, as it is emitted from the parent object (light source), it travels at two speeds: (1) Ejection Speed (Absolute Light Speed) which is subject to the ejection force and direction, and (2) Inertia Speed (Inertia Light Speed) which is subject to the speed and direction of parent object (light source). This is called "Inertia Transformation" [10].

In contrast, Phonon is not a particle emitted from the vibrator (sound source). Instead, it is the particle of the medium (air or water) which carries the transmitted energy from the vibrator (sound source) and radiates at the nature speed of the medium in all directions. This is called "Non-inertia Transformation".

VI. Equation of Light Speed

Light speed (Normal Light Speed) observed at a reference point **C'** is the vector summation of light speed observed at light source **C** (Absolute Light Speed 3×10^8 m/s) and the speed of light source observed at the reference point **V** (Inertia Light Speed). This is known as Equation of Light Speed [11] which was first proposed with solid definitions by Edward Wu in 2017 [10] and can be represented as follows:

$$\mathbf{C' = C + V}$$

In addition, Absolute Light Speed is dependent on the local gravitational field, no matter the light sources and observers. Also, Inertia Light Speed is dependent on the relative speed between the light source and the reference point.

VII. Relativity versus Yangton and Yington Theory

Einstein's Relativity is based on two wrong assumptions: (1) Light speed is constant no matter light sources and observers, and (2) Spacetime is dependent on acceleration. In fact, light speed is not constant and spacetime is dependent on gravitational field instead of acceleration. However, because gravitational acceleration can be generated by gravitational field, therefore, General Relativity can still be used to explain

most of the physical phenomena such as Dimension, Duration, Velocity, and Spacetime which are actually caused by gravitational field.

"Space" and "Time" are absolute nature quantities. They don't change with anything at all. However "Dimension" of a corresponding identical object and "Duration of a corresponding identical event can change with the local gravitational field and aging of the universe. This is because that Wu's Unit Length l_{yy}(diameter) and Wu's Unit Time t_{yy}(period) of Wu's Pairs (building blocks of the universe) are dependent on the local gravitational field and aging of the universe.

In fact, all properties of a corresponding identical object or event are dependent on the local gravitational field and aging of the universe such as Dimension ($L\infty l_{yy}$), Duration ($T\infty l_{yy}^{3/2}$), Velocity ($V \infty l_{yy}^{-1/2}$) and Acceleration ($A\infty l_{yy}^{-2}$). Accordingly, photon as a corresponding identical object, $\lambda \infty l_{yy}$ and $C \infty l_{yy}^{-1/2}$ (Absolute Wavelength and Light Speed observed at light source) which are also dependent on the local gravitational field and aging of the universe. For example, Absolute Light Speed is $3x10^8$ m/s on earth which is bigger on moon (smaller gravity) and smaller on Saturn (larger gravity) because like Wu's Unit Length l_{yy}, the normal unit quantity m/s is also dependent on the local gravitational field.

Although Yangton and Yington Theory agrees with General Relativity that Dimension, Duration, Speed, Acceleration and Spacetime of an object or event are dependent on the local gravitational field, however, the relativistic factor $1/(1-V^2/C^2)^{1/2}$ that is derived from the postulation "Light speed is constant no matter light sources and observers" is false. It doesn't apply to Yangton and Yington Theory and there is no fixed formula for the correlation between Wu's Unit Length and the local gravitational field (or aging of the universe).

VIII. Optical Doppler Effects

The Doppler Effect can be proved easily in the Non-Inertia Transformation Process with the signal source traveling at a constant speed either toward or away from the observer such as that of sound propagation. However, photon emission from the light source is an Inertia Transformation Process. According to Equation of Light Speed, Normal Light Speed (wavelength and frequency) can change with: (1) Absolute Light Speed which is dependent on the local gravitational field and aging of the universe such as Cosmological Redshift and Gravitational Redshift, and (2) Inertia Light Speed which is dependent on the relative speed between light source and reference point such as Axial Doppler Shift, Acceleration Doppler Shift and Transverse Doppler Shift.

Despite the influence caused by Absolute Light Speed, Optical Doppler Effects caused by the influence of relative speed between light source and reference point (observer), including Axial Doppler Shift, Acceleration Doppler Shift and Transverse Doppler Shift are analyzed in detail as follows:

IX. Axial Doppler Shift

Fig. 1 is an Absolute Space System at light origin (reference point). Because the star is far away from earth, both earth and light origin are literally stationary to each other, therefore earth can also be considered as a reference point for the same Absolute Space System. As a result, all the measurement observed on earth is the same as that observed at the light origin in the same Absolute Space System.

The light source (star) can either move toward or away from the observer on earth. Assuming it takes time t for a photon traveling from light origin to earth. V_o is the speed of the light source (star) at the beginning, V_t is the speed of the light source (star) at time t and a is the constant acceleration of the light source (star) in time t. S is the distance of the light source (star) traveling from the light origin in time t. P is the distance of the photon traveling from the light origin to earth at time t, $V_o t$ is the distance of the photon dragged by the light source (star) in time t and D is the distance between the light source (star) and the photon when the photon reaches earth at time t. Also λ1 is the wavelength, ν1 is the frequency and C1 is the light speed of the photon observed on light origin and earth. With the above notations, Blueshift and Redshift caused by Optical Doppler Effects can be studied as follows (Fig. 1):

First, the distance vectors between light origin, light source (star) and photon can be correlated to each others as follows:

OS = **S** = Distance vector from light origin to light source (star) = Movement of light source (star) away from light origin.

SP = **D** = Distance vector from light source (star) to photon = Vision of light observed from light source (star).

OP = P = Distance vector from light origin to photon = Vision of light observed from light origin and ground.

OP = OS + SP

P = S + D

D = P – S

Also, according to Equation of Light Speed, when photon separate from the light source (star), the speed of photon observed at the light origin C' is equal to the vector summation of light speed observed at the light

source (star) C (Absolute Light Speed $3x10^8$ m/s) and the speed of the light source (star) observed at the light origin V_0. Therefore,

$\mathbf{C' = C + V_0}$

And

$\mathbf{OP = P = C't = Ct + V_0t = Ps}$

$\mathbf{OS = S = V_0t + \frac{1}{2} at^2 = Ss}$

$\mathbf{D = P - S = (P - S)s}$

Where C' is the light speed observed at the light origin, C is the Absolute Light Speed observed at the light source (star), V_0 is the initial moving speed of light source (star) observed at the light origin and t is time, s is the positive unit vector toward earth.

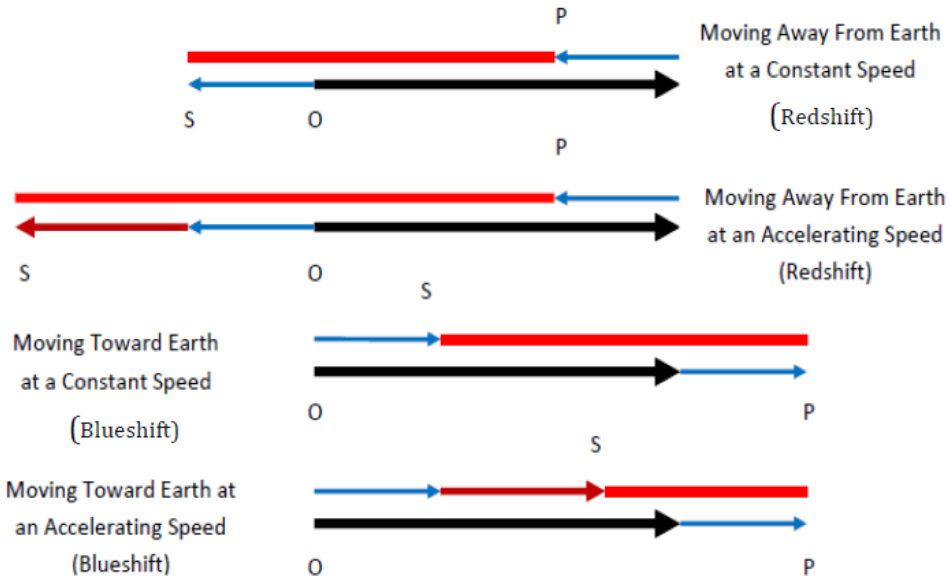

Fig. 1 Redshift and Blueshift caused by Axial Doppler and Acceleration Doppler Effects.

When the light source (star) either moves toward or away from the observer (reference point) on earth at a constant speed ($V_o = V_t$ and $a = 0$), Blueshift and Redshift can be observed respectively. This is called "Axial Doppler Shift" ("Axial Doppler Effect") [12]. A detailed analysis is discussed as follows:

A. Blueshift

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

$S = V_ot$

$P = Ct + V_ot$

$D = P - S = Ct$

Therefore,

$\lambda_1 = D/\nu t = Ct/\nu t = C/\nu = \lambda$

$C_1 = P/t = (Ct + V_ot)/t = C + V_o$

$C_1 > C$

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

$\nu_1 = (1 + V_o/C)\,\nu$

$\nu_1 > \nu$

When the light source (star) moves toward earth (reference point) at a constant speed, the wavelength maintains unchanged, but both frequency and light speed become bigger, Such that Blueshift can be observed.

B. Redshift

In case the light source (star) moves away from earth (reference point),

$S = -V_ot$

$P = Ct - V_ot$

$D = P - S = Ct$

Therefore,

$\lambda_1 = D/\nu t = Ct/\nu t = C/\nu = \lambda$

$C_1 = P/t = (Ct - V_ot)/t = C - V_o$

$C_1 < C$

$\nu_1 = C_1/\lambda_1 = (C - V_o)/\lambda$
$\nu_1 = (1 - V_o/C)\,\nu$
$\nu_1 < \nu$
When the light source (star) moves away from earth (reference point) at a constant speed, the wavelength maintains unchanged, but both frequency and light speed become smaller, such that Redshift can be observed.

X. Acceleration Doppler Shift

When the light source (star) either moves toward or away from the observer (reference point) on earth at an acceleration speed ($Vo \neq Vt$ and $a \neq 0$), Blueshift and Redshift can be observed respectively. This is called "Acceleration Doppler Shift" ("Acceleration Doppler Effect") [13]. A detailed analysis is discussed as follows:

A. Blueshift

In case the light source (star) moving toward the observer (reference point) on earth at a constant acceleration speed,
$S = V_o t + \frac{1}{2} at^2$
$P = Ct + V_o t$
$D = P - S = Ct - \frac{1}{2} at^2$
Therefore,
$\lambda_1 = D/\nu t = (Ct - \frac{1}{2} at^2)/\nu t = (C - \frac{1}{2} at)/\nu < \lambda$
$C_1 = P/t = (Ct + V_o t)/t = C + V_o$
$C_1 > C$
$\nu_1 = C_1/\lambda_1$
$\nu_1 = ((C + V_o)/(C - \frac{1}{2} at))\,\nu$
$\nu_1 > \nu$
When the light source (star) moves toward earth (reference point) at a constant acceleration speed, the wavelength becomes smaller, both the frequency and light speed become bigger, such that Blueshift can be observed.

B. Redshift

In case the light source (star) moving away from the observer (reference point) on earth at a constant acceleration speed,
$S = -(V_o t + \frac{1}{2} at^2)$
$P = Ct - V_o t$
$D = P - S = Ct + \frac{1}{2} at^2$
Therefore,
$\lambda_1 = D/\nu t = (Ct + \frac{1}{2} at^2)/\nu t = (C + \frac{1}{2} at)/\nu > \lambda$
$C_1 = P/t = (Ct - V_o t)/t = C - V_o < C$
$\nu_1 = C_1/\lambda_1$
$\nu_1 = ((C - V_o)/(C + \frac{1}{2} at))\,\nu$
$\nu_1 < \nu$
When the light source (star) moves away from earth (reference point) at constant acceleration speed, the wavelength becomes bigger, both the frequency and light speed become smaller, such that Redshift can be observed.

XI. Transverse Doppler Shift

Furthermore, when the light source (star) moves at a constant speed in the transverse direction to the observer, week Redshift can be observed. This is called "Transverse Doppler Shift" ("Transverse Doppler Effect") [14]. A detailed analysis is discussed as follows:

Fig. 2 illustrates the correlations between Normal Light Speed **C'**, Absolute Light Speed **C** and Inertia Light Speed **V** during Transverse Doppler Shift. Where **C'** is the light speed observed at the reference point, **C** is the light speed observed at the light source and **V** is the speed of the light source observed at the reference point.

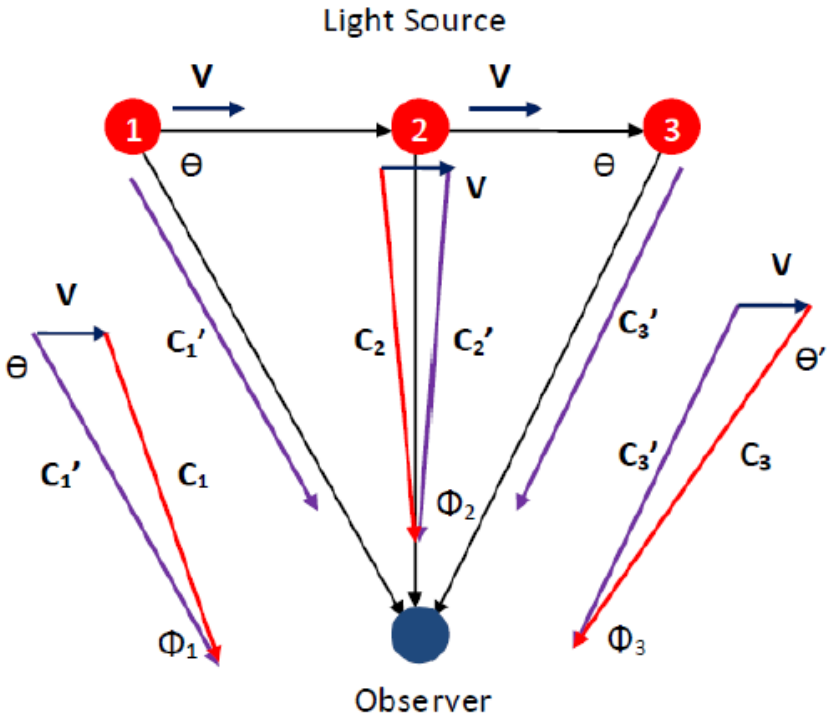

Fig. 2 Transverse Doppler Shift and Equation of Light Speed.

A. At the beginning of transverse (position 1)

The angle between V and C_1' is Θ, and the angle between C_1' and C_1 is Φ_1 (extremely small).

Because

$\mathbf{C_1' = C_1 + V}$

Therefore,

$C_1' = C_1 \text{ Cos } \Phi_1 + V \text{ Cos } \Theta$

Also,

$\text{Cos } \Phi_1 = 1$

$C_1 = C$

Therefore,

$C_1' = C + V \text{ Cos } \Theta$

And

$\lambda_1 = C_1'/\nu = (C + V \text{ Cos } \Theta)/\nu$

$C/\nu = \lambda$

Therefore,

$$\lambda_1 = \lambda + V \text{ Cos } \Theta/\nu$$

B. At the closest position between light source and observer (position 2)

The angle between V and C_2' is 90^0, and the angle between C_2' and C_2 is Φ_2 (extremely small).

Because

$\mathbf{C_2' = C_2 + V}$

Therefore,

$C_2' = C_2 \text{ Cos } \Phi_2 + V \text{ Cos } 90^0$

Also,

$\text{Cos } \Phi_2 = 1$

$C_2 = C$

$\text{Cos } 90^0 = 0$

Therefore,

$C_2' = C$

And

$\lambda_2 = C_2'/\nu = C/\nu$

$C/\nu = \lambda$

Therefore,

$$\lambda_2 = \lambda$$

C. At the ending of transverse (position 3)

The angle between V and C_3' is Θ', and the angle between C_3' and C_3 is Φ_3 (extremely small).

Because

$\mathbf{C_3' = C_3 + V}$

Therefore,

$C_3' = C_3 \text{ Cos } \Phi_3 - V \text{ Cos } \Theta'$

Also,

$\text{Cos } \Phi_3 = 1$

$C_3 = C$

$\Theta' = \Theta$

Therefore,

$C_3' = C - V \text{ Cos } \Theta$

And

$\lambda_3 = C_3'/\nu = (C - V \text{ Cos } \Theta)/\nu$

$C/\nu = \lambda$

Therefore,

$$\lambda_3 = \lambda - V \text{ Cos } \Theta/\nu$$

In general, two types of typical observations can be obtained. They are analyzed as follows:

1. Observation from beginning to the closest position

In case it is observed from the beginning of the transverse (position 1) to the closest position between light source and observer (position 2), then the average wavelength is

$\lambda_{12} = ½ (\lambda_1 + \lambda_2)$

$\lambda_{12} = \lambda + ½ V \text{ Cos } \Theta/\nu$

Therefore,

$$\lambda_{12} > \lambda$$

As a result, during the transverse from the beginning (position 1) to the closest position between the light source and the observer (position 2), subject to V and Θ, various Redshifts can be observed.

2. Observation from beginning to end

In case it is observed from the beginning (position 1) to the end of the transverse (position 3), then the average wavelength is

$\lambda_{13} = ½ (\lambda_1 + \lambda_3)$

$\lambda_{13} = ½ [(\lambda + V \text{ Cos } \Theta/\nu) + (\lambda - V \text{ Cos } \Theta/\nu)]$

Therefore,

$$\lambda_{13} = \lambda$$

As a result, during the transverse from the beginning (position 1) to the end (position 3), subject to the relative moving speed between the light source and the observer V, and the angle Θ between V and C', Redshifts can be observed in the beginning of the transverse process, and eventually everything fade away at the end.

XII. Conclusion

Despite relativism, Axial Doppler Shift, Transverse Doppler Shift and Acceleration Doppler Shift can be interpreted and derived by Equation of Light Speed **C' = C + V**, where Normal Light Speed **C'** (light speed observed at the reference point) is a vector summation of Absolute Light Speed **C** (light speed observed at light source 3 x 10^8 m/s) and Inertia Light Speed **V** (speed of light source observed at reference point). Absolute Light Speed is dependent on the local gravitational field and aging of the universe. Inertia Light Speed on the other hand is dependent on the relative motion between light source and reference point. As a result, subject to the relative speed and direction between light source and reference point, different types of Optical Doppler Shifts can be interpreted and derived by Equation of Light Speed such as Axial Doppler Shift generated by constant speed of light source in axial direction; Transverse Doppler Shift caused of constant speed of light source in various directions from sight; and Acceleration Doppler Shift resulted from constant acceleration of light source in axial direction.

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