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# A Revised Derivation of Hubble's Law by Wu's Spacetime Shrinkage Theory

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***[Abstract]***
*A revised derivation of Hubble's Law by Wu's Spacetime Shrinkage Theory is proposed. The methodology of the derivation is discussed in detail. Because that Hubble's Law can be successfully derived from Wu's Spacetime Shrinkage Theory, instead of Acceleration Doppler Effect, the expansion of the universe can also be interpreted by Wu's Spacetime Shrinkage Theory due to aging of the universe with no concern of dark energy.*
***[Keywords]***
*Hubble's Law, Redshift, Cosmological Redshift, Acceleration Doppler Effect, Expansion of Universe, Wu's Pairs, Spacetime Shrinkage, Reverse Expansion, Dark Energy.*

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## I. Introduction

Although Hubble's Law can be used to explain the expansion of the universe that is derived successfully from the Acceleration Doppler Effect [1], it is hard to believe that a star can move faster than light speed also with an acceleration pumped by a mysterious Dark Energy [2]. To avoid these problems, Wu's Spacetime Reverse Expansion Theory [3] based on Wu's Spacetime Shrinkage Theory [4] is proposed to interpret Hubble's Law [5].

According to Wu's Spacetime Shrinkage Theory, the shrinkage of the circulation period ($t_{yy}$) and orbital size ($l_{yy}$) of Wu's Pairs [6] are caused by the aging of the universe. As a consequence, a photon emitted from a star more than 5 billion years ago has a larger wavelength than that on the present earth, which causes Cosmological Redshift [7] and obeys Hubble's Law.

## II. Hubble's Law

The discovery of the linear relationship between Redshift and distance for stars more than 5 billion years away, coupled with a supposed linear relation between recessional velocity and Redshift yields a straight forward mathematical expression for "Hubble's Law" (Fig. 31) [50] as follows:

$$V = H_0D$$

Where

- V is the recessional velocity, typically expressed in km/s.
- $H_0$ is Hubble constant and corresponds to the value of H (often termed the Hubble parameter a value that is time dependent and 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) the 3-space defined by given cosmological time. (Recession velocity is just V = dD/dt).

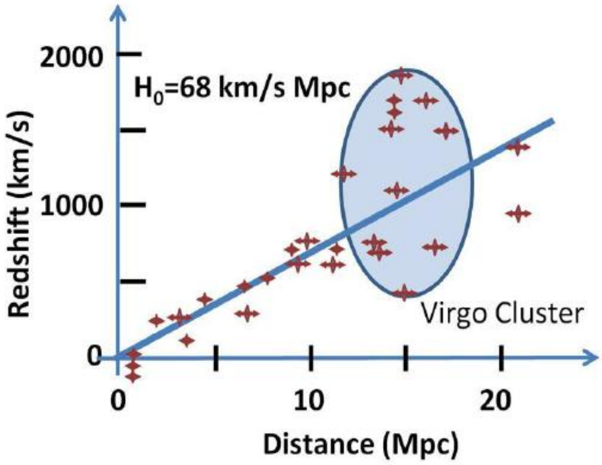


Fig. 31 Hubble's Law – the linear relationship between Redshift and distance.

## III. Derivation of Hubble's Law by Wu's Spacetime Shrinkage Theory

To derive Hubble's Law from Wu's Spacetime Shrinkage Theory is not difficult, however, I have made some mistakes in my previous publications [8][9]. With a careful analysis, a new approach is presented as follows:
First, let's address some important facts in the simulated model:

1. The photons that causing Redshift comes from a star 5 billion years ago.
2. $\lambda_i$ is the wave length of the photons generated from the star 5 billion years ago. (Same as is on earth).
3. During this period, according to Wu's Spacetime shrinkage Theory, Wu's Unit Length ($l_{yy}$) on earth reduced from $l_{yyi}$ to $l_{yyf}$. Meanwhile the Normal Unit Length used for measurement reduced from $L_i$ (meter of 5 billion years ago) to $L_f$ (meter at present time).
4. The distance X between the star and the earth maintains unchanged.
5. The vision of star (the traveling distance of the star observed on earth) is $D_E$, the distance from $M_iL_f$ to $M_fL_f$, where $M_i$ and $M_f$ are the Amount of Normal Unit Length measured by $L_i$ and $L_f$.
6. The velocity of the star observed on earth is dM/dt with a unit "meter/second" on present earth.
7. According to Wu's Spacetime Theory ($t_{yy} = \gamma\, l_{yy}^{3/2}$) and Principle of Correspondence ($L \propto l_{yy} \propto \lambda$), because $\lambda_i$ is proportional to $L_i$ and $\lambda_f$ is proportional to $L_f$, therefore redshift $(\lambda_i - \lambda_f)/\lambda_f$ is proportional to $(L_i - L_f)/L_f$.

Figure C shows a schematic diagram of the visions of star on earth. In the beginning (when photon is emitted from the star), the distance X measured on earth between the star and earth is the multiplication of the Normal Unit Length $L_i$ and the Amount of Normal Unit Length $M_i$. At the final stage (when the photon reaches the earth), the distance of the star X measured on earth becomes the multiplication of the Normal Unit Length $L_f$ and the Amount of Normal Unit Length $M_f$. The distance of the star X stays the same. But the vision of the star $D_E$ reflects the distance of the star moves from initial distance $M_iL_f$ to the final distance $M_fL_f$ observed on earth. Because $M_fL_f$ is much bigger than $M_iL_f$, $D_E$ is approximately equal to the distance X between the star and earth (Fig. C).

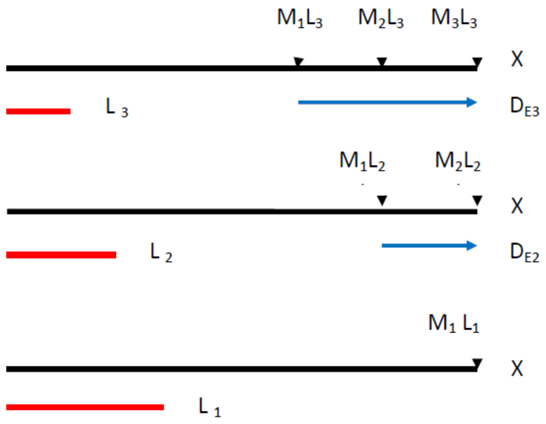


Fig. C The distance of a star measured by a shrinking ruler on earth.

Because
$D_E = ML - M_1L = X - M_1L$
$d(D_E) = d(X - M_1L)$
$dD_E = - M_1 dL$
Where X and $M_1$ are constants.
Therefore,

$$dD_E \propto -dL$$

And
$X = ML$
$dM = X\, dL^{-1}$
Therefore,

$$dM \propto dL^{-1}$$

Also,

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

Therefore,

$$dD_E \propto -d\,\lambda$$
$$dM \propto d\,\lambda^{-1}$$

Give integration to $dD_E$,
$D_{Ef} - D_{Ei} \propto \lambda_i - \lambda_f$
$D_{Ei} = 0$

$$D_E \propto (\lambda_i - \lambda_f)/\lambda_f$$

Give integration to dM,
$M_f - M_i \propto 1/\lambda_f - 1/\lambda_i$
$M_f - M_i \propto (\lambda_i - \lambda_f)/\,\lambda_i\,\lambda_f$

$$M_f - M_i \propto (\lambda_i - \lambda_f)/\lambda_f$$

Where $D_E$ is the vision of star (star traveling distance observed on earth), M is the Amount of Normal Unit Length of the vision of star. $\lambda_f$ is the wavelength on present earth and $\lambda_i$ is the wavelength 5 billion years ago on both the star and earth. $\lambda_f$ is a constant and $\lambda_i$ is a number close to a constant. $(\lambda_i - \lambda_f)/\lambda_f$ is the redshift.
Also, the Amount of Normal Unit Velocity "v" of the traveling star can be represented by:
$v = (M_f - M_i)/t$
Therefore,

$$vt \propto (\lambda_i - \lambda_f)/\lambda_f$$

Because both $D_E$ and vt are proportional to $(\lambda_i - \lambda_f)/\lambda_f$, also $D_E$ is approximately equal to the distance D between the star and earth, therefore,

$$v = kD/t$$

Given

$$H_0 = k/t$$

Therefore,

$$v = H_0 D$$

Where k is a constant, D is the distance between the star and earth, "v" is the amount of star traveling velocity and $H_0$ is Hubble Constant.

As a result, Hubble's Law can also be derived from Wu's Spacetime Shrinkage Theory. Because of this reason, instead of the expansion of the universe due to the Acceleration Doppler Effect, Hubble's Law can also be interpreted by Wu's Spacetime Shrinkage Theory due to aging of the universe. Therefore, the truth is that "the universe doesn't expand, it stays unchanged except that Wu's Spacetime is shrinking all the time". This is named "Wu's Spacetime Reverse Expansion Theory".

I. Wu's Spacetime Reverse Expansion Theory Versus Universe Expansion Theory

During Wu's Spacetime shrinkage process, the potential energy of Yangton and Yington circulating pairs can be converted to their kinetic energy with no need of external energy. Also, the distance between the star and earth remains unchanged at all time. There are no such things as that the star is undergoing acceleration and moving at a speed faster than the light speed. Because of these reasons, it is believed that Wu's Spacetime Reverse Expansion Theory based on Wu's Spacetime Shrinkage Theory is more realistic than Universe Expansion Theory in explanation of Cosmological Redshift and Hubble's Law.

## IV. Conclusion

A revised derivation of Hubble's Law by Wu's Spacetime Shrinkage Theory is proposed. The methodology of the derivation is discussed in detail. Because that Hubble's Law can be successfully derived from Wu's Spacetime Shrinkage Theory, instead of Acceleration Doppler Effect, the expansion of the universe can also be interpreted by Wu's Spacetime Shrinkage Theory due to aging of the universe with no concern of dark energy.

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