New Concepts And Derivation For Hubble's Linear Law

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Abstract: During the cosmic evolution, magnitude of Planck's constant increases with increasing cosmic time. This may be the root cause of observed cosmic red shifts. Thus the observed red shift is directly proportional to the age difference of our galaxy and distant galaxy. Hubble's linear law can be derived with these new ideas.

Key words: Cosmic red shift; Planck's constant; Galaxy age difference; Dark energy;

1. INTRODUCTION

In the early part of the twentieth century, Slipher, Hubble and others made the first measurements of the redshifts and blueshifts of galaxies beyond the Milky Way. They initially interpreted these redshifts and blueshifts as due solely to the Doppler effect, but later Hubble discovered a rough correlation between the increasing redshifts and the increasing distance of galaxies [1,2]. Theorists almost immediately realized that these observations could be explained by a different mechanism for producing redshifts. Hubble's law of the correlation between redshifts and distances is required by models of cosmology derived from general relativity that have a metric expansion of space. As a result, photons propagating through the expanding space are stretched, creating the cosmological redshift. More mathematically, the viewpoint that "distant galaxies are receding" and the viewpoint that "the space between galaxies is expanding" are related by changing coordinate systems. Expressing this precisely requires working with the mathematics of the Friedmann-Robertson-Walker metric.

Hubble's law states that for small distances the redshift is proportional to the distance. At large distances the linearity of Hubble's law breaks down and the distances depend on the energy density of the universe. Finally Hubble's interpretations lead cosmologists to propose the surprising 'accelerating universe' [3]. The accelerating universe is the observation that the universe appears to be expanding at an increasing rate. In formal terms, this means that the cosmic scale factor has a positive second derivative, so that the velocity at which a distant galaxy is receding from us should be continuously increasing with time.

For a cosmologist, there are only few parameters needed to describe the universe. All models are based on Einstein's theory of general relativity. The world models are characterized by two parameters: the current rate and the deceleration of the expansion. The first parameter is called the Hubble constant after Edwin Hubble, who discovered the cosmic expansion in 1929. The other parameter describes the change of the expansion and depends on the energy density and the curvature of the universe. The contributions to the density are expressed as fractions of the critical density. The expansion itself is typically measured by the redshift. This is the ratio of the scale factor at two different times of the expansion and observed as a shift of spectral features to longer wavelengths.

2. DARK ENERGY

In physical cosmology or in astronomy, 'dark energy' is a hypothetical form of energy that permeates all of space and tends to accelerate the expansion of the universe [4]. Dark energy is the most accepted hypothesis to explain observations since the 1990s that indicate that the universe is expanding at an accelerating rate. In the standard model of cosmology, dark energy currently accounts for 73% of the total mass-energy of the universe.

The nature of this dark energy is a matter of speculation. The evidence for dark energy is only indirect coming from distance measurements and their relation to redshift. It is thought to be very homogeneous, not very dense and is not known to interact through any of the fundamental forces other than gravity. Since it is quite rarefied-roughly 10^{-29} grams per cubic centimeter-it is unlikely to be detectable in laboratory experiments. The two leading models are a cosmological constant and quintessence. Both models include the common characteristic that dark energy must have negative pressure!

3. NEW CONCEPTS

To unify gravity and electromagnetism, to understand the cosmic redshits, to understand the cosmic expansion and to eliminate the dark energy concept, authors proposed new concepts in their submitted paper [5]. This paper can be considered as its extension. The observed cosmic red shifts can also be interpreted in the following way:

1) During the cosmic evolution, magnitude of Planck's constant (h) increases with increasing cosmic time and the quantum of energy gradually increases. At present, at all galaxies (either aged or younger), value of Planck's constant is same.
2) Past light quanta emitted from aged galaxy will have less Planck's constant and show a red shift with reference to the receiving younger galaxy.
3) During journey light quanta will not lose its energy.
4) $\frac{d(h)}{dt}$ is a measure of cosmic rate of expansion. It may be noted that, as the universe is accelerating, value of Planck's constant increases. Thus if there is no change in the magnitude of Planck's constant, it can be suggested that, at present there is no cosmic acceleration.

4. NEW DERIVATION FOR COSMIC RED SHIFT

Let us revise the basic definition of (z) as follows:

$$z \cong \frac{\lambda_0 - \lambda_G}{\lambda_0} \cong \frac{\Delta\lambda}{\lambda_0} \text{ but not } \frac{\Delta\lambda}{\lambda_G} \tag{1}$$

Here λ_0 is the wave length of light at our galaxy and λ_G is the wave length of light at old galaxy. Note that when $\Delta\lambda$ is very small or $\lambda_0 \cong \lambda_G$

$$\frac{\Delta\lambda}{\lambda_0} \cong \frac{\Delta\lambda}{\lambda_G} \tag{2}$$

Please note that, by Hubble's time the observed maximum red shift was 0.003. With that red shift it is not possible to decide the correct definition of z. Based on the increasing value of the Planck's constant, red shift (z) will be directly proportional to the age difference of our galaxy and the old galaxy (Δt).

$$z \propto \Delta t \tag{3}$$

$$z \cong H_0 \Delta t \tag{4}$$

Here H_0 is the proportionality constant. In this way H_0 can be incorporated directly. Note that, when $\Delta t \to 0 \quad \Rightarrow \quad \Delta\lambda \to 0 \quad \Rightarrow \text{z} \to 0.$ Thus

$$\Delta t \cong \frac{z}{H_0} \cong \frac{\Delta\lambda}{\lambda_0} \cdot \frac{1}{H_0} \tag{5}$$

Thus by knowing the galaxy red shift, galaxy age difference can be estimated. Multiplying relation (5) both sides with c

$$c\Delta t \cong z \cdot \frac{c}{H_0} \tag{6}$$

If $c\Delta t$ represents the distance between our galaxy and the distant old galaxy,

$$d \cong c\Delta t \cong z \cdot \frac{c}{H_0} \tag{7}$$

Quantitatively it represents the original Hubble's law and qualitatively differs from the modern cosmic acceleration.

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