# RELATIVISTIC TIME CORRECTION ON MOVEMENT OF DISTANT GALAXIES MAKES THE PRESENT AGE OF THE UNIVERSE AS 28.2 BILLION YEARS

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## Abstract

*The relativistic approach gives us the apparent time of the events happening on a fast moving object away from us. It is called scale factor. It is given by* **Scale factor = 1+z,** *where* **z = v/c**, *v= velocity of moving object and c= speed of light in vacuum. This paper aims to illustrate that the above relativistic time correction when applied to Hubble's law, gives us the age of the universe as* **2/H₀** *and not* **1/H₀**, *where* **H₀** *is the present Hubble constant. This makes the age of the universe to a value double that of the present estimate. That is from* **14.1** *billion light years to* **28.2** *billion light years. Linear expansion of the universe is assumed.*

## I. INTRODUCTION

According to big bang theory, universe is expanding. Hubble's law gives us the distances of galaxies from us and also their velocities of recession from the observer. The Hubble constant at present is about 70 km/sec/M Parsec. That means a galaxy at a distance of one mega parsec is moving at 70km/sec. one mega parsec is approximately equal to 3.3 light years. So, for a galaxy appearing at one billion light
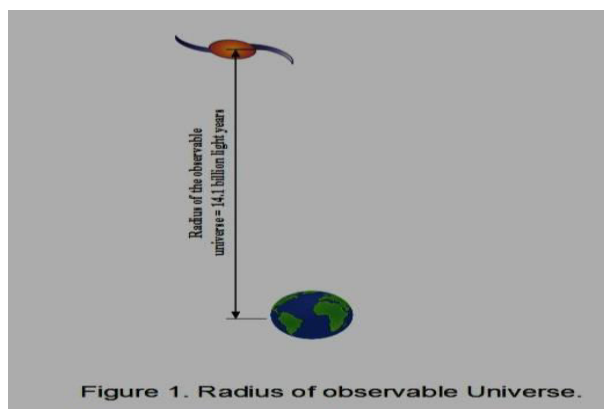


Figure 1. Radius of observable Universe.

years from us, the recession velocity is 21000km/sec. But maximum possible velocity is equal to velocity of light. So, this puts the limit on the most distant galaxy that we can see as **14.1** billion light years away from us.  This is called the radius of the observable universe, as shown in figure 1. This is given by $1/H_0$. It is calculated from the simple logic that:
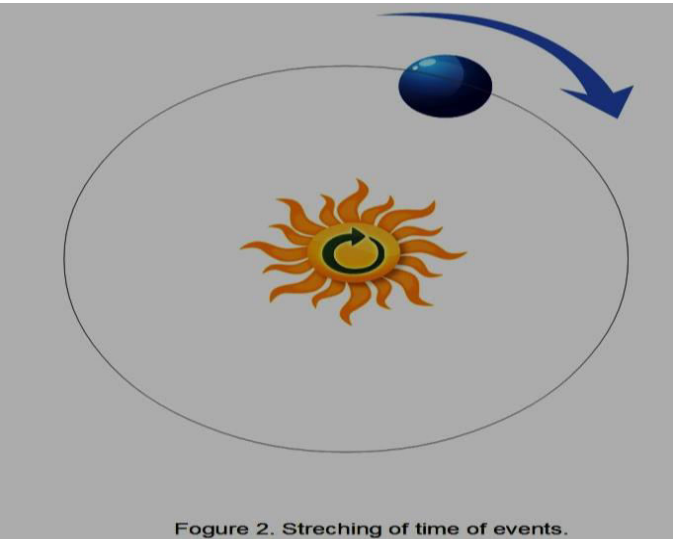
**Time= distance / velocity.**

## II.    CONTRADICTION IN ABOVE METHOD

The latest information of the farthest galaxy is GN z11, having red shift 11. It is at apparent distance of 13.4 billion light years from Earth. That means, light that we have just received is giving information about 13.4 billion years old. This galaxy is reported to be containing stars.  Suppose there is a Sun like star of about 5 billion years old, then that star was formed at about 13.4+5=18.4 billion years ago. (In fact, present age of this star is to be multiplied by 1+z =1.98. So it is 5x1.98= 9.9 billion light years.

But we have just received light from that galaxy and hence cannot see the past life of star). But 18.4 billion years is greater than the present estimated age of the universe. It means that star was formed even before big bang! This is happening because; we are not applying relativistic time correction to galaxies.

## III.    APPLYING RELATIVISTIC TIME CORRECTION

According to Einstein's theory of relativity, apparent time of objects moving away at constant velocity is stretched by a factor (1+z), as said above.  If a galaxy is travelling at say 0.5c, then z=0.5 and scale factor = 1+z = 1+0.5 = 1.5.

This means every one second of time on that galaxy appears as 1.5 seconds for us. This happens to every event happening in that galaxy. If a planet in that galaxy is revolving around a star in that galaxy taking one year, we see it as 1.5 years (figure 2.). The most important part is that this is applicable to the movement of the galaxy itself. That means, the apparent velocity of galaxy will be 1.5 times less than the actual velocity as estimated by Hubble's law. Then how can Hubble's law gives the actual velocity? This is because the important fact  from theory of relativity that there will be no change in the velocity of light emitted irrespective of the velocity of the moving object from which it is

Fogure 2. Streching of time of events.

coming out. Illustration of the concept:  As shown in figure 3, let us consider a galaxy just started from us. Let it moving away from us at velocity z=0.5. To reach one light year actual distance, it takes two years.  We see it as taking 2x1.5= 3 years.

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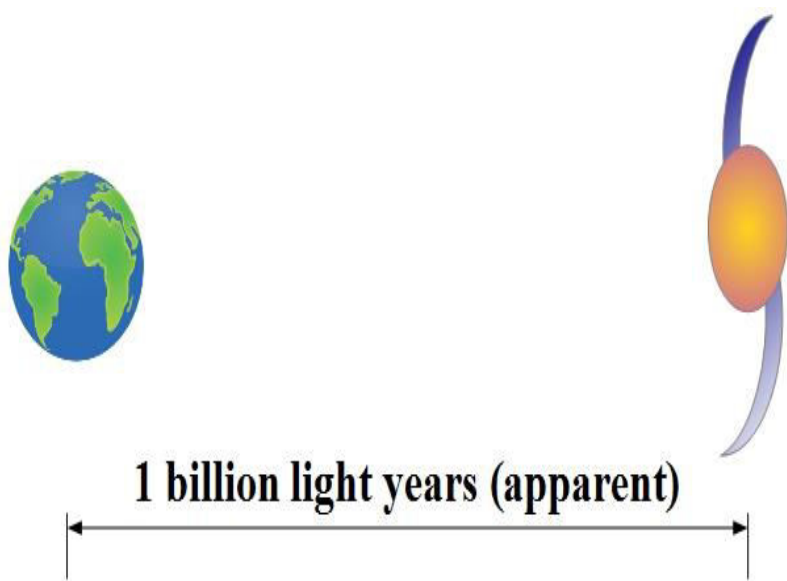
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**Figure 3: Example of a galaxy moving away**

That means, it will appear at 1 light year after 3 years. So, its apparent speed is 0.3333. In case of the farthest known galaxy at present, GN z11, we have z = 0.98. So, for every one hour on that galaxy, we feel 1.98 hours on Earth, as shown in figure 4.
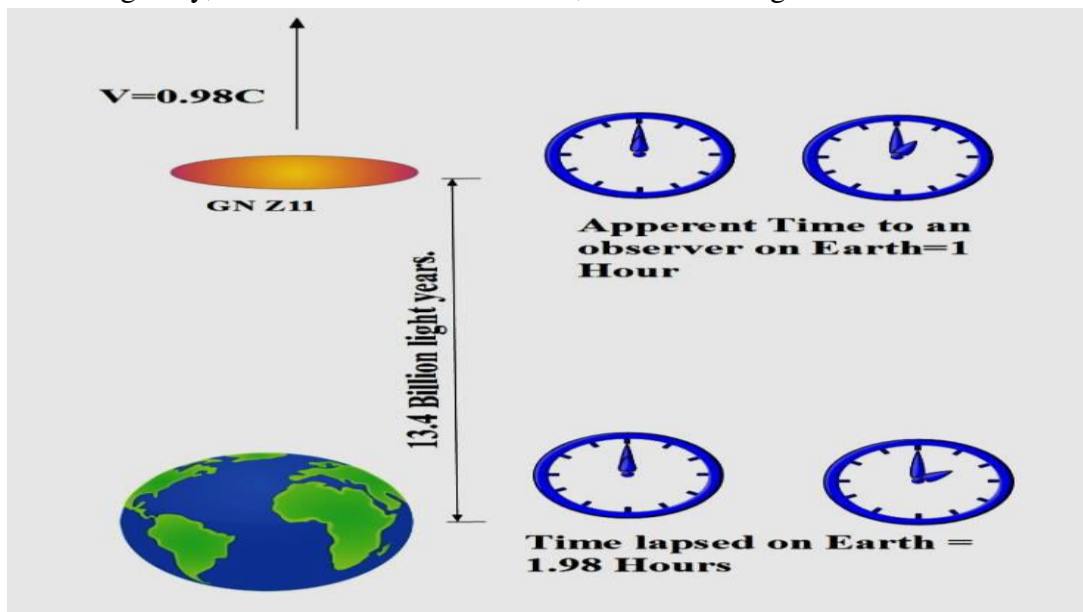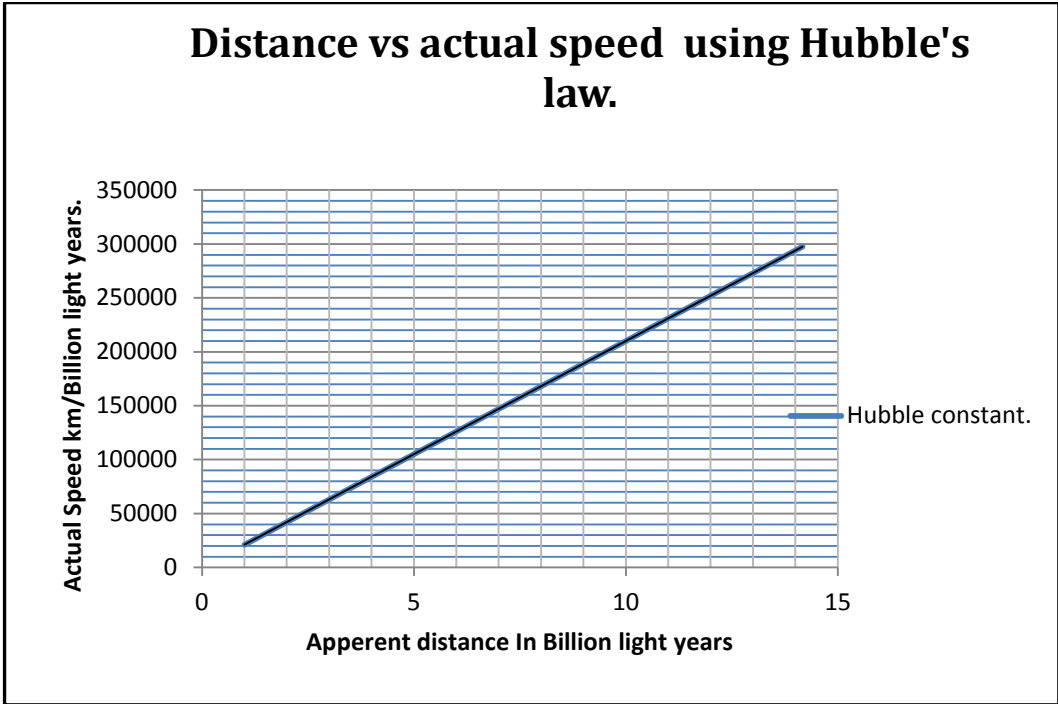


**Figure 4: Relative Time Concept**

## IV.    SOLUTION TO ABOVE CONTRADICTION AFTER APPLYING RELATIVISTIC TIME CORRECTION

Now, in case of GN z11, we are seeing 5 billion years star of 13.4 billion years old information. So it is 5x1.98= 9.9 billion light years old.  Then it is 13.4 +9.9 =23.3 billion light yrs.Subtracting from corrected age of 28.2, we get 28.2-23.3=4.9 billion light yr. Hence there is no contradiction at all.

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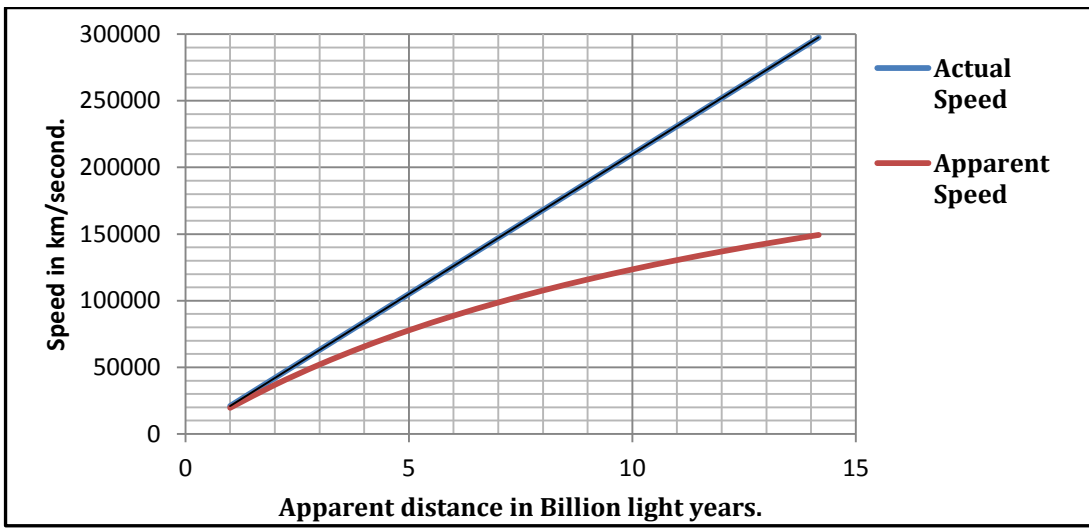**5258**

## V. RESULTS AND DISCUSSIONS



**Figure 5: Illustration of Hubble's law.**
Figure 5: Illustrates the linear correlation between distance and speed of galaxies.
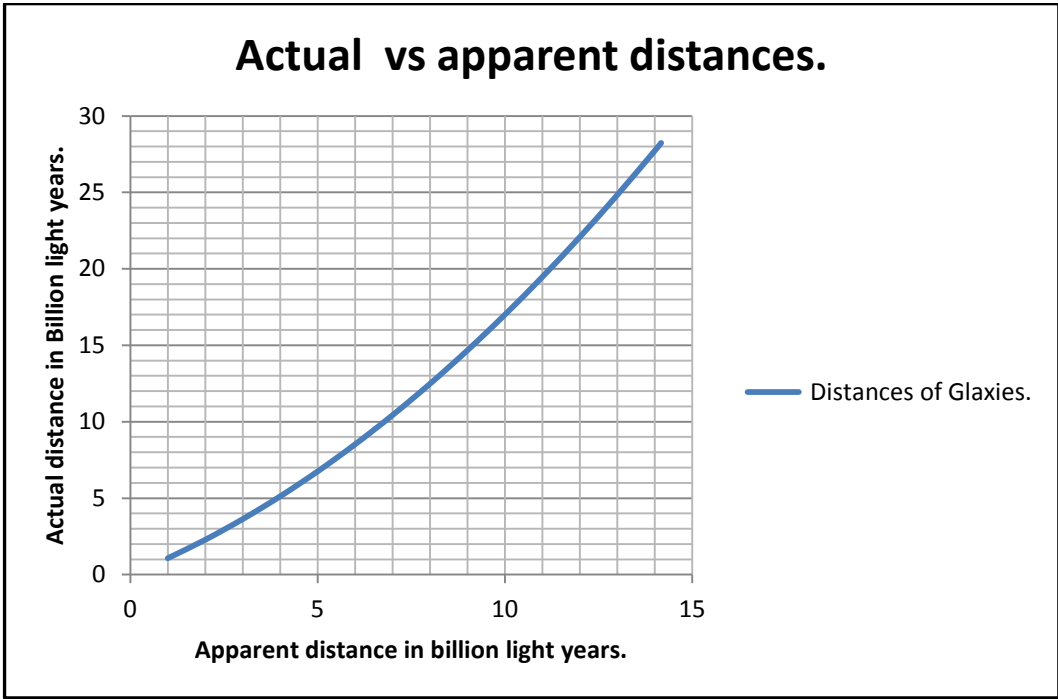


**Figure 6: Actual distance v/s apparent distances**

Figure 6 shows the real factor causing the error. In the relation Time = distance/ velocity, it was apparent distance / actual velocity was used. Actually, it should be

Time = apparent distance/ apparent speed.

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**Figure 7: Actual speed and Apparent speed against apparent distances.**

Figure 7 shows the degree of error between two speeds with respect to apparent distances of galaxies.

## VI.    CONCLUSION

 The maximum value of z=1, when v=c. So, if a galaxy at the edge of the observable universe is moving at z=1, apparent speed= 0.5c as, the scale factor =1+z=2. That means in travelling 14.1 billion light years of apparent distance, it must have taken 2x14.1=**28.2 billion years.** That means, actual age of the universe = twice the apparent age = **2/H$_0$**. This result is obtained after applying relativistic time correction to the speed of galaxies.

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**To Cite This Paper**

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