On the Geocentric Nature of Hubble Law

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Abstract

The isotropic nature of the cosmic red shift may lead to a geocentric universe if the red shift is interpreted as caused by the recessional motion of the heavenly bodies, a key argument for the Big Bang Theory (BBT). To defend BBT from falling into a geocentric theory, it is argued that the universe is expanding linearly from the singularity, the heavenly bodies would appear to be running away from each other with isotropic velocity distribution with respect to any observer, even if the point of reference is not at the center of the universe. In this article we will prove with both classical and relativistic theories that this argument is invalid, and an isotropic velocity distribution with respect to the earth will logically lead to a geocentric universe.

1. Introduction

The spectroscopic red shift of the stars plays a crucial role in modern cosmology. It has been discovered that the spectroscopic red shift of a star is by and large linearly proportional to its distance from the earth. Hubble proposed that the red shift was caused by Doppler effect due to the receding movement of the stars and galaxies, which logically suggested an ever expanding universe[1,2]. It has been further proposed that such expansion originated from a Big Bang.

An expanding universe with all heavenly bodies moving away from the earth seems to suggest a geocentric theory which is evidently false. To defend BBT from falling into a geocentric theory, it is argued that if the universe is expanding linearly from the singularity, the heavenly bodies would appear to be leaving away from each other with isotropic velocity distribution with respect to the observer on earth. The validity of the Big Bang Theory (BBT) is therefore crucially dependent on the linearity of Hubble's law. Any genuine non linear function would suggest that our earth is located at the center of the universe which is highly improbable. The linearity of Hubble's law is far from being conclusive. As a matter of fact, the Hubble's constant is not even accurately determined to within a factor of two. This constant is believed to be anywhere from 35 to 100 km s^{-1} Mpc^{-1} [3-5]. It is well known that for large values of the red shift ($z \approx 1$), the connection between z and the velocity of the galaxy is no longer linear. To save the Big Bang theory, the non linearity is attributed to a number of possibilities[6], such as the difficulties in accurate determination of stellar distances, the modification of the inverse-square law relating brightness to distance in a curved space time, the decrease of the energy of the light brought about by the reduction of the frequency of the light wave, the evolution in the luminosity of galaxies with time since the Big Bang, etc. The deviation from linearity depends also on the density parameter that discriminates between cosmological models. Since there is no general agreement

about the corrections needed to be made for the non linearity of Hubble's law, any established genuine non linearity would invalidate the Big Bang theory all together.

In 1992, Segal and Nicoll[7] provided a direct challenge to the linear Hubble law with statistical analysis of data of more than 2000 galaxies. The statistical analysis has convincingly proven that the cosmic red shift is proportional to the square of the distance. Textbook presentations of Hubble's law typically report measurement on bright cluster galaxies only. The samples are often subjectively selected from the catalog of Abell[8] which explicitly assumes Hubble's law in its selection criterion. The sample of Hoessel et al.[9], which provides one of the major supports for Hubble's law, consists of 116 galaxies drawn entirely from the Abell catalog.

It is a common knowledge that a non linearity of Hubble's law will inevitably lead to a geocentric universe. It is also generally believed that a strictly linear Hubble's law would save the Big Bang theory from falling into a geocentric system. In this article we will prove such believing a misconception. We will show that even strict linearity of Hubble's law would not save the Big Bang theory as long as the velocity distribution of galaxies is isotropic with respect to the earth.

2. The raisin pudding model (balloon model)

The argument to rescue the Big Bang theory from falling into a geocentric theory can be summarized as follows: Referring to Fig 1, the origin of the X-O-Y system is the original singularity of the Big Bang. The point E is the position of the earth at the present time. Its distance from the singularity is r_0. For convenience we choose the line joining the singularity O and the earth E to be the X axis without losing generality. Consider two galaxies C and D whose displacement vectors in the reference frame of the singularity are $\mathbf{r}_1$ and $\mathbf{r}_2$, respectively. According to Hubble's law, the velocities of C and D obey the following relationship:

$$\mathbf{v}_1 = H(t)\, \mathbf{r}_1(t) \qquad (1a)$$

$$\mathbf{v}_2 = H(t)\,\mathbf{r}_2(t) \tag{1b}$$

$$\mathbf{v}_0 = H(t)\,\mathbf{r}_0(t) \tag{1c}$$

where $\mathbf{v}_1$, $\mathbf{v}_2$ and $\mathbf{v}_0$ are respectively the velocities of the galaxies C, D and the earth. Note that the Hubble constant is a function of time t. In the reference frame of the earth, the velocity vectors of galaxies C and D are

$$\mathbf{v'}_1 = \mathbf{v}_1 - \mathbf{v}_0 = H(t)\,\mathbf{r}_1(t) - H(t)\,\mathbf{r}_0(t) = H(t)\,\mathbf{r'}_1(t) \tag{2}$$

$$\mathbf{v'}_2 = \mathbf{v}_2 - \mathbf{v}_0 = H(t)\,\mathbf{r}_2(t) - H(t)\,\mathbf{r}_0(t) = H(t)\,\mathbf{r'}_2(t) \tag{3}$$

Eqs. (2) and (3) show that if Hubble's law is linear in the reference frame of the original singularity, then it remains linear in the reference frame of the earth, as long as the displacement vectors $\mathbf{r}_1(t)$, $\mathbf{r}_2(t)$, $\mathbf{r}_0(t)$ and the Hubble constant H(t) are measured at the same time t. The simultaneity of measurement and the linearity of Hubble's law are two necessary conditions to preserve the isotropy of cosmic receding velocity in both the Big Bang reference frame and the earth frame. Only when these two necessary conditions are satisfied the Doppler shift interpretation of the cosmic red shift might not lead to a geocentric theory. This picture of linear expansion is the so called raisin pudding model (or the balloon model) of the Big Bang cosmology, which is widely reproduced in texbooks.

3. The flaw of the raisin pudding model or balloon model

The argument of the raisin pudding model or the balloon model described in section **2** depends on two crucial conditions: 1) The velocities and the positions of the earth and the galaxies must be measured simultaneously; and 2) The velocity transformation between the two reference frames must be linear. The first condition can not be satisfied due to the limit of speed of light; and the second condition can not be satisfied due to non linear velocity transformation of relativity.

For the sake of argument, let us first forget the non linear velocity transformation of relativity and analyze the problem within the classical theory, see if a linear transformation can save the Big Bang theory from falling into a geocentric theory. A relativistic analysis will be given in the next section.

Let us consider the galaxies located, say, 5 billion light years from the earth. These galaxies would be on a spherical surface with a radius of 5 billion LY with the earth at the center of the sphere, which is the point E* in Fig 2. Note that the positions and the velocities of these galaxies measured on earth today were all the instantaneous values 5 billion years ago when the universe was about 10 billion years old. (The Big Bang Theory claims the age of the universe to be about 15 billion years.) Let us denote this time as t and the present time as t*. At the time t the earth was located at a much closer distance from the singularity, about two thirds of the present distance, which is indicated as the position E in Fig 2. The moment when the earth was at E is simultaneous with the moment when photons started leaving the galaxies on the spherical surface toward the earth at the future position E* (Time is not relative in classical theory). Apparently, these galaxies are not equally distant from the point E. Consider the two galaxies A and B on x-axis that are aligned with the earth and the singularity of Big Bang. Galaxy A is between the singularity and the earth, while galaxy B is at the far side of the diameter. According to the raisin pudding model, the velocities of the galaxies A, B and the earth are linearly proportional to their instantaneous distances from the singularity O at the time t :

$$\frac{v_A}{OA} = \frac{v_B}{OB} = \frac{v_E}{OE} = H(t) \tag{4}$$

The relative velocities of A and B with respect to the earth are, respectively,

$$v_A' = v_A - v_E = H(t)\,(OA - OE) = H(t)\,AE \tag{5}$$

$$v_B' = v_B - v_E = H(t)\,(OB - OE) = H(t)\,BE \tag{6}$$

From Eqs. (5) and (6) we have

$$\frac{v_A'}{v_B'} = \frac{AE}{BE} < 1 \qquad (7)$$

Eq.(7) shows that the relative speeds with respect to the earth, v_A' and v_B' of A and B, are not equal if the galaxies are expanding with velocities proportional to their distances from the singularity. This would manifest a non isotropy of the red shift, with the galaxies farther away from the singularity than the earth showing greater red shift and the one behind earth showing smaller one. It contradicts the isotropy of Hubble's law as observed on earth.

4. Relativistic Analysis

The Big Bang theory is built on the theory of relativity. Violating relativity would constitute a logical inconsistency. The galaxies at large distance have red shifts significant enough to show relativistic effect. For example, quasars have been reported to have red shifts as high as 4. A relativistic analysis of the isotropy of Hubble's law is in order.

Referring to Fig 3, the reference frame X'EY' of the earth is moving with a velocity of V_E in the reference frame XOY of the Big Bang. Consider the galaxies on a spherical surface about the earth in the earth system. The galaxy C on this sphere has a coordinate (x',y',t') in the earth system, and (x,y,t) in the Big Bang system. Note that the events of photons leaving these galaxies are simultaneous with respect to the observer on the earth, but not simultaneous with the event when these photons arrive at the point E*, which is the present time of detection t*:

$$t^* = t' + R/c \qquad (8)$$

According to the special theory of relativity, when the photons leave the galaxy C towards the earth, the coordinates of this galaxy in the Big Bang system are given by

$$x = \gamma (x' + V_E t') \qquad (9)$$

$$t = \gamma (t' + V_E x'/c^2) \tag{10}$$

with $$\gamma = \frac{1}{\sqrt{1 - \frac{v_E^2}{c^2}}} \tag{11}$$

Inversely,

$$x' = \gamma (x - V_E t) \tag{12}$$

$$t' = \gamma (t - V_E x/c^2) \tag{13}$$

Eq (13) can be rewritten as

$$t = t' / \gamma + V_E x/c^2 \tag{13a}$$

Eqs (10), (13) and (13a) are different representations of the time dilation.

In the earth system, the galaxies are on a spherical surface with radius R:

$$x'^2 + y'^2 = R^2 \tag{14}$$

But $x'^2 + y'^2 = \gamma^2 (x - V_E t)^2 + y^2 = = \gamma^2 [x - V_E (t' / \gamma + V_E x/c^2)]^2 + y^2 = R^2$

We obtain

$$\left[\frac{x - \gamma V_E t'}{\gamma} \right]^2 + y^2 = R^2 \tag{15}$$

Eq (15) shows that the sphere of galaxies as seen in the earth system is a spheroid in the Big Bang system with a semi major of γR and a semi minor of R, centered at the point ($x = \gamma V_E t'$, $y = 0$).

According to the raisin pudding model of the Big Bang theory, the galaxies are expanding from the singularity with velocities proportional to its displacement vector. The velocity of the galaxy C in the singularity system obeys Hubble's law:

$$V_x = H x \tag{16}$$

$$V_y = H y \tag{17}$$

where the Hubble constant is the instantaneous value at the time t. The velocity of the galaxy C with respect to the earth is

$$V_x' = \frac{V_x - V_E}{1 - \frac{V_x V_E}{c^2}} \tag{18}$$

$$V_y' = \frac{\gamma V_y}{1 - \frac{V_x V_E}{c^2}} \tag{19}$$

Plugging Eqs (16) and (17) into Eqs (18) and (19) gives:

$$V_x' = \frac{\gamma Hx' + V_E(\gamma Ht' - 1)}{1 - \frac{\gamma HV_E(x' + V_E t')}{c^2}} \tag{20}$$

$$V_y' = \frac{\gamma Hy'}{1 - \frac{\gamma HV_E(x' + V_E t')}{c^2}} \tag{21}$$

Eqs (20) and (21) show that the velocity of the galaxy C as measured in the earth system is not a linear function of the displacement vector unless $V_E = 0$, which manifests a geocentric theory.

Eqs (20) and (21) also gives the ratio of (V_x' / V_y'):

$$\frac{V_x'}{V_y'} = \frac{x'}{y'} + \frac{V_E(\gamma Ht' - 1)}{\gamma Hy'} \tag{22}$$

Eq (22) shows that the velocity vector is not even parallel to the displacement vector in the earth system, unless $V_E = 0$, which reiterates a geocentric theory.

5. Conclusion

Both classical and relativistic analysis prove rigorously that isotropic Hubble's law in the reference frame of the earth leads logically to a geocentric universe, which means the earth is right at the singularity of the Big Bang. This is worse than the medieval geocentric theory, because not

only we know that the earth is not even at the center of the solar system, but also, we fail to observe the earth displaying any of the novel features of a singularity, such as space being turned into time and wise versa, as the Big Bang theory alleged. The Big Bang Theory also claims that no law of physics is valid at the singularity. It would invalidate the Big Bang Theory itself if the Earth is at the singularity.

The whole problem is originated from the Doppler shift explanation of the red shift, which ascribes the cosmic red shift to the receding movement of the heavenly bodies from the earth. Hubble himself was never happy with the velocity interpretation of the red shift. Wang's Dispersive Extinction Theory (DET)[10], however, interprets the red shift as being caused by the dispersive extinction of the star light by the space medium, and therefore does not lead to a geocentric universe. This lends a strong support to DET against BBT. `

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Sur la Nature géocentrique de la loi Hubble

Mots Clés: la théorie géocentrique, la loi Hubble, le glissement rouge, la théorie Big Bang, la théorie d'extinction dispersive

Résumé

La nature isotropique du glissement cosmique rouge pourrait mener à un univers géocentrique si on interprète le glissement rouge comme provoqué par le mouvement de récession des corps célestes, un argument clé pour la théorie Big Bang (BBT). Pour défendre la théorie Big Bang de tomber dans une théorie géocentrique, on soutient que l'univers est en expansion linéaire de la singularité, il semblerait que les corps célestes s'enfuient l'un de l'autre avec une distribution isotropique de vitesse par rapport à n'importe quel observateur, même si le point de réference n'est pas au centre de l'univers. Dans cet article, nous allons prouver avec la théorie classique et relativiste que cet argument est non valable, et une distribution isotropique de vitesse par rapport à la terre mènera logiquement `a un univers géocentrique.

Caption to the figures

Figure 1. The raisin pudding model: The isotropy of the velocity distribution is preserved in both the Big Bang reference system and the earth reference system if Hubble's law is strictly linear, as long as the velocity from the remote galaxies can be measured instantaneously and the velocity transformation is linear.

Figure 2. Classical analysis of the isotropy of velocity distribution: The isotropy of velocity distribution of galaxies can not be conserved in both the Big Bang system and the earth system, due to the fact that the velocities of the galaxies at large distance is the instantaneous value at an earlier time t* when the earth is at the position E', which is closer to the singularity O than the current position E.

Figure 3. Relativistic analysis of the isotropy of velocity distribution: The isotropy of velocity distribution of galaxies can not be conserved in both the Big Bang system and the earth system due to constancy of the speed of light and the non linearity of velocity transformation between reference frames. See main text for detail.

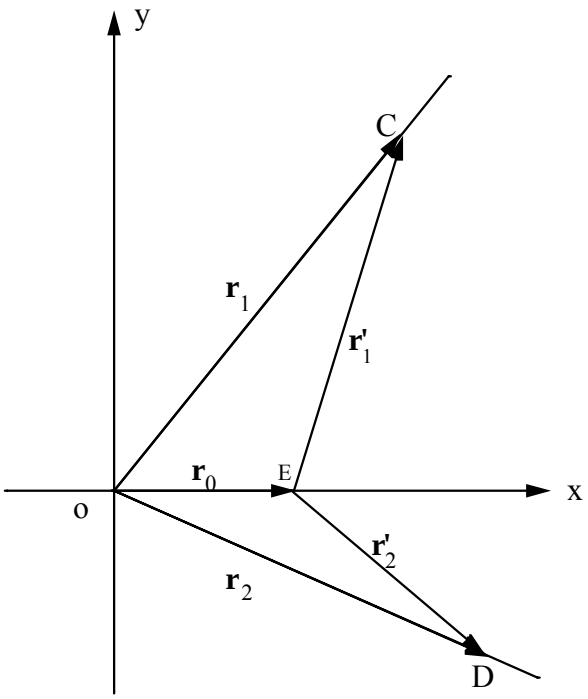

Figure 1

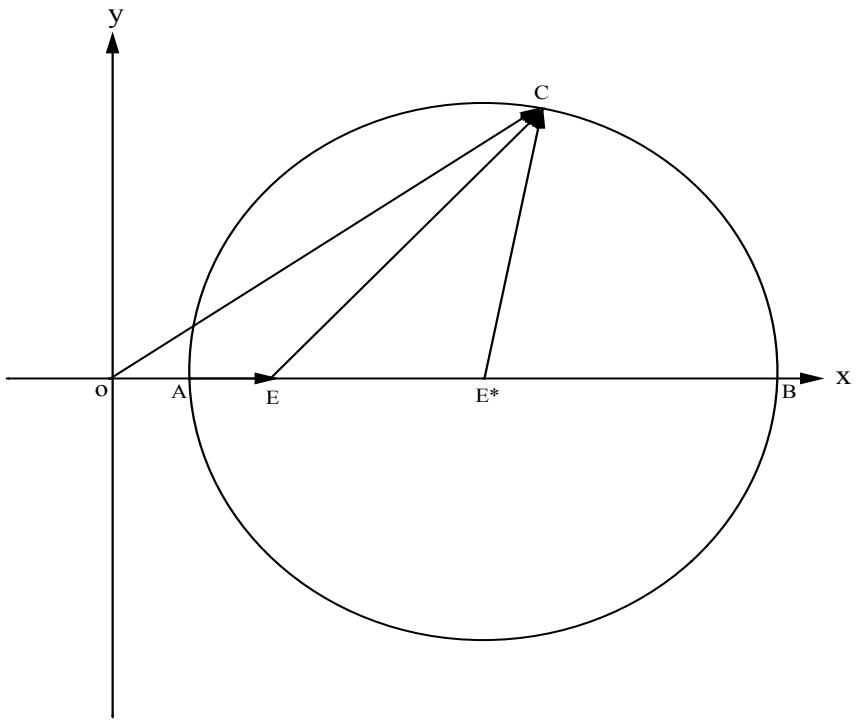

Figure 2

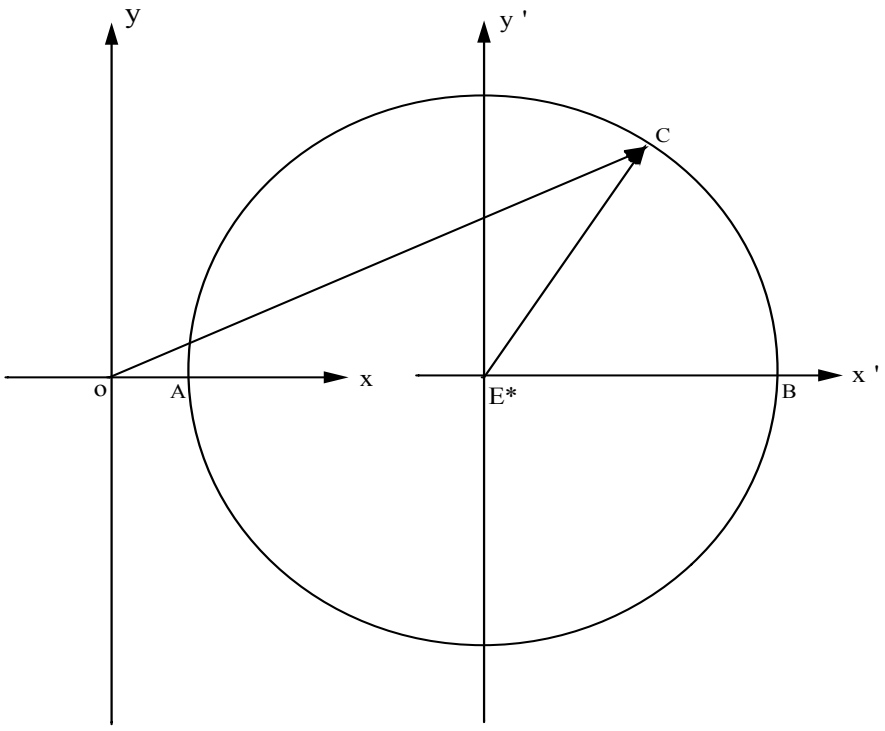

Figure 3