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THE ISSUE ABOUT THE ABERRATION AND RED SHIFT OF STELLAR LIGHT PROPAGATED TO THE SURFACE OF THE EARTH

Lu Shan
Zhuhai Entry-Exit Inspection and Quarantine Bureau

ABSTRACT: *The cause of the aberration of stellar light propagated to the surface of the earth was believed as the result of the light velocity superposition, and the red shift was the result of the space change in the past physics. It can be derived from the conclusion of the article "Metric in Reference System Transformation" that the aberration and red shift of the stellar light Propagated to the surface of the earth are the result of the wave length change of the star moving relative to the earth instead of the result of either the light velocity change or the space change. Therefore，it is inappropriate to explain the aberration with velocity superposition theory or to invoke the red shift to prove the Big Bang Theory.*

Key Words: stellar aberration; stellar red shift; relative motion
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INTRODUCTION

In 1725 British astronomer James Bradley found the aberration, and believed that the aberration was caused by the superposition of the earth's orbital motion velocity and the limited velocity of stellar light. In 1929 American astronomer Edwin· P· Hubble obtained the spectra of more than 40 galaxies and found all these spectra showed universal red shift, which was believed as the first observational evidence of the expansion of the space and is invoked as an important evidence of the Big Bang Theory nowadays [2–5]. As the wave length change of the star moving relative to the earth was regarded as constant, doubts about the cause of aberration and red shift of stellar light propagated to the earth always exist. Why light velocity could be superposed since it has been proved by experiments to be constant? Is it appropriate that for the aberration the physics only took account of the earth movement without considering the result of the solar movement? Why the stellar spectra observed by Edwin· P· Hubble illustrated the universal red shift? Is it reasonable to invoke the red shift to prove the Big Bang Theory? However, if the wave length change of the star moving relative to the earth was regarded as changing, according to the conclusion of the article "Metric in Reference System Transformation" [1], a new theoretical thinking can be provided for the aberration and red shift of the stellar light propagated to the surface of the earth.

Corresponding author's E-mail: zhuhailushan@outlook.com Tel: 0756-3219063 Fax: 0756-3219538
Address: No.1144, East of Jiuzhou Avenue, Zhuhai 519015, Guangdong Province P. R. China

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Calculation and Analysis

The aberration and red shift of the stellar light propagated to the surface of the earth are shown in Fig. 1, and the stellar light velocity is set as c, the light wave length of star stationary relative to the earth as λ, the stationary coordinate of the star relative to the earth as k, the coordinate in the state of motion with velocity u relative to the earth as k', the ratio between the stellar motion velocity relative to the earth u and the light velocity c as m. The angle between the stellar motion direction and the direction vertical to the earth is set as β, the aberration angle of the stellar light propagated to the surface of the earth as α, the wave length change of the star moving relative to the earth as λ'.

When k' is stationary relative to k, i.e. $u=0$, as shown in Fig. $1(a)$, the distance of the star relative to the earth, i.e. the optical distance of the stellar light propagated to the earth is

$$r = r_1 = r_2 = n\lambda' = n\lambda \qquad (1)$$

The wave length of the stellar light propagated to the surface of the earth is

$$\lambda = \lambda'$$

The aberration angle of the stellar light propagated to the surface of the earth is

$$\alpha = 0^o$$

When k' moves with velocity u relative to k, i.e. $u>0$, as shown in Fig. $1(b)$, from Eq. (1) of the article "Metric in Reference System Transformation" the star moving distance along the motion direction with the velocity u is

$$r_m = mn\lambda \qquad (2)$$

The following equation can be obtained by cosine theorem:

$$r_m = mn\lambda = \sqrt{r^2 + r'^2 - 2rr'\cos\alpha}$$

As $m = u/c$, $r' = n\lambda'$, then the stellar motion velocity relative to the earth

$$u = \frac{c}{\lambda}\sqrt{\lambda^2 + \lambda'^2 - 2\lambda\lambda'\cos\alpha} \qquad (3)$$

According to the vector decomposition method, the star motion along the motion direction with the velocity u can be decomposed into two mutually perpendicular sub-motions: one is the motion parallel to the earth motion direction; the other is the motion vertical to the earth motion direction.

The star moving distance along the direction parallel to the relative earth motion direction is:

$$x_m = r_m \sin\beta = nm\lambda\sin\beta \qquad (4)$$

The star moving distance along the direction vertical to the earth motion direction is:

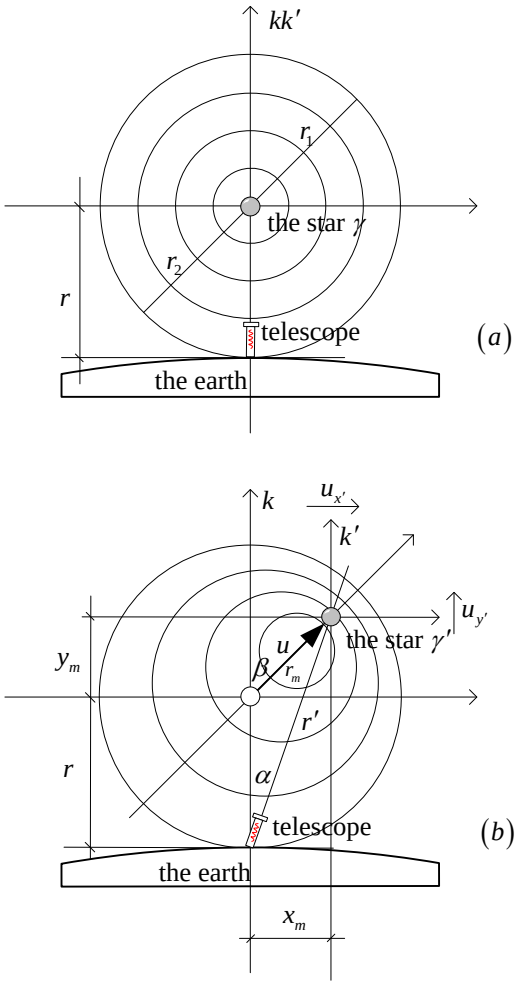

Fig.1 the Aberration and Red Shift of Stellar Light Propagated to the Surface of the Earth.

(a) the star in static state relative to the earth

(b) the star in motion state relative to the earth

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$$y_m = r_m \cos\beta = nm\lambda \cos\beta \qquad (5)$$

As the star moving distance x_m along the direction parallel to the relative earth motion direction is mutually perpendicular to the distance $r + y_m$ vertical to the earth motion direction, the distance of the star relative to the earth, i.e. the optical distance of stellar light propagated to the surface of the earth can be obtained by Pythagorean theorem:

$$r' = \sqrt{(r + y_m)^2 + (x_m)^2}$$

Substituting (1) (4) (5) into the equation above:

$$r' = n\lambda\sqrt{1 + 2m\cos\beta + m^2}$$

As $r' = n\lambda'$, the stellar light wave length propagated to the surface of the earth, i.e. the stellar light wave length observed by telescope is:

$$\lambda' = \lambda\sqrt{1 + 2m\cos\beta + m^2} \qquad (6)$$

The aberration angle of the stellar light propagated to the surface of the earth, i.e. the slant angle observed by telescope can be obtained by sine theorem or tangent theorem:

$$\alpha = \sin^{-1}\frac{x_m}{r'} = tg^{-1}\frac{x_m}{r + y_m}$$

Substituting (1) (4) (5) into the equation above:

$$\alpha = \sin^{-1}\frac{m\lambda\sin\beta}{\lambda'} = tg^{-1}\frac{m\sin\beta}{1 + m\cos\beta} \qquad (7)$$

It can be seen that $\alpha = 0^o$ and $\lambda = \lambda'$ when $m = 0$. When $m > 0$, $\sin\alpha$ is in direct proportion to $\sin\beta$ and in inverse proportion to λ', and vise versa. When $\beta = 0^o$, then $\alpha = 0^o$, the Eq. (3) can be adapted into the equation $u = (\lambda \mp \lambda')c/\lambda$; when $\beta = 90^o$, then $\alpha = tg^{-1}u/c$ can be obtained from the Eq. (7).

DISCUSSION

Before the conclusion of article "Metric in Reference System Transformation"[1] was proposed, the physics believed that the light velocity and the light wave length were both constant. In this premise the light velocity superposition theory was believed as the cause of the aberration and the red shift was invoked to prove the Big Bang Theory[2–5], which led to the misunderstanding about the aberration and red shift of the stellar light propagated to the surface of the earth. However, as the light velocity has been proved by many experiments to be constant, according to the conclusion of the article "Metric in Reference System Transformation", it can be derived that the light wave lengths vary in different motion states of the stars relative to the earth as the stellar light velocity does not depend on the stellar motion. It will be no significance unless the light wave length is specified. It can be seen that as the light velocity c is constant, when $m > 0$ and $\beta = 0^o$, the Eq. (3) can be adapted as $u = (\lambda \mp \lambda')c/\lambda$, which is completely consistent with the presentation about the Doppler effect. When $\beta = 90^o$, then $\alpha = tg^{-1}u/c$ can be obtained from the Eq. (7). Although such form is completely consistent with James Bradley's presentation about the aberration, it can be found that the aberration of the stellar light propagated to the surface of the earth is not the result of the light velocity superposition but the change of the light wave

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length of the star in relative motion state. What is worth noting is that the star moves constantly relative to the earth. According to the principle of relative motion, since the movements include the rotation of the earth and the earth's movements along with the solar system and the Galaxy, the diurnal aberration, annual aberration and long-term aberration are different when the star is observed on the earth. Therefore, it is lack of basis to account for aberration only from the aspect of the earth movement without considering the result of the solar movement. Not only that, affected by the sunlight what the observer sees is the star departing from the motion direction of the earth as the observer on the earth always moves with the sun whose revolution velocity is far greater than that of the earth. Like the observation of the distant lights in the driving vehicle at night, the observer, affected by the vehicle light, can only see the distant lights departing from the driving vehicle direction, but can rarely see the distant lights by the driving vehicle direction. Thus, the stellar spectra the observer sees on the earth show universal red shift as the stellar light wavelength expands departing from the earth motion direction. Not only that, the universal red shift of the stellar light is not the result of space change but the result of the light wavelength expansion as the star departs from the earth motion direction. Therefore, it is inappropriate to explain the aberration with velocity superposition theory or to invoke the red shift to prove the Big Bang Theory.

The above description about the aberration and red shift of stellar light propagated to the surface of the earth is only applicable when the relative motion state of the star is observed on the earth, but this inadequate discussion can provide a certain clear concept for the detection using the sound wave or the electromagnetic wave (light wave), without which the targets of the active detection and passive detection of relative motion will not be locked accurately.

According to the conclusion of the article "Metric in Reference System Transformation", it can be found the aberration and red shift of the stellar light propagated to the surface of the earth are the result of the change of the light wave length of the star in relative motion state instead of the result of either the light velocity change or the space change. It is hard for physics which is used to regarding the "measuring-rod" for distance as constant to accept that the light wave length of the star in relative motion state can be regarded as changing if the light is used to measure the distance. Re-understanding the relationship of the light source motion and the light wavelength makes it clear that neither the aberration of stellar light propagated to the surface of the earth is caused by the light superposition nor the red shift is caused by the space change. What is more important, the light wave is not constant, but changing with the motion of the light source, and it is such nature that makes people think it lacking support to regard the light wave length of the star in relative motion state as constant. Just like walking, when you ask someone how far he has walked, you will be confused if he only gives you the number of steps he has taken. The answer will be meaningless unless he describes clearly what the "step" is. Unfortunately, the physics does not realize that the light wave length of the star in relative motion state are changing in nature, which is why the doubts always exist about explaining the aberration with velocity superposition theory or invoking the red shift to prove the Big Bang Theory.

Thus, rethinking the aberration and red shift according to the conclusion of the article "Metric in Reference System Transformation" may be helpful for physical theory in indicating cosmic observation.

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CONCLUSION

The aberration and red shift of the stellar light propagated to the surface of the earth are the result of the change of the light wave length of the star in relative motion state instead of the result of either the light velocity change or the space change.

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