An Argument Against the Special Theory of Relativity

Thanh G Nguyen

1. Abstract: This argument is a section in my book, *Beyond the World of Relativity to the World of Invariance*. In this section, we are going to analyze the light aberration to show that the special theory of relativity is inconsistent with the constancy of the speed of light.

2. Aberration of Light

Let us imagine that we are watching rain. We can state that rain will fall vertically when there is no wind. If we move, then the rain will appear to fall at an angle. The faster we move, the more tilted the angle is. A similar phenomenon has been observed with light, which is called aberration of light. Aberration of light is an astronomical phenomenon where an observer sees a light source appearing at different positions and angles depending on his motion. In the picture on the left, the observer is at rest and is right under a light source. If either the observer or the light source is moving, then the light source will appear at an angle. We call this angle apparent angle.

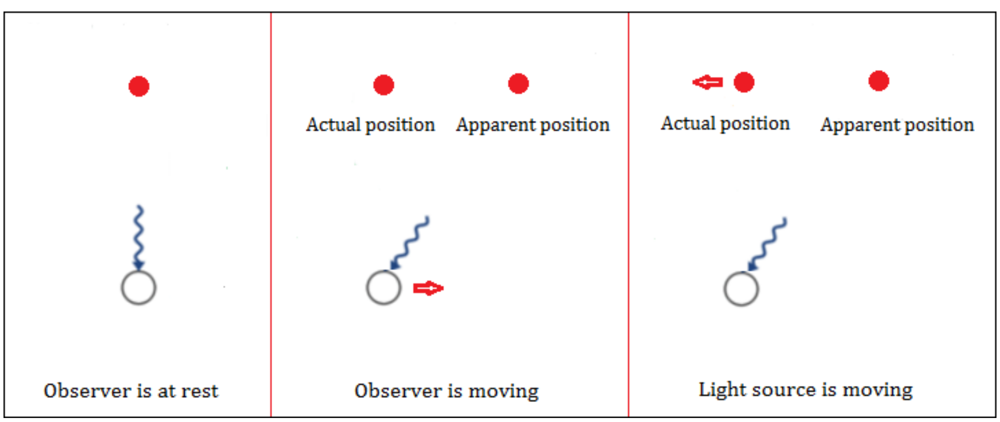

Figure 10.1: The aberration of light.

10.1. Explanation in Classical Mechanics

The aberration of stars has been observed since the late seventeenth century. The English astronomer James Bradley proposed the first explanation in 1727, which says that the phenomenon came from the Earth revolving around the Sun.

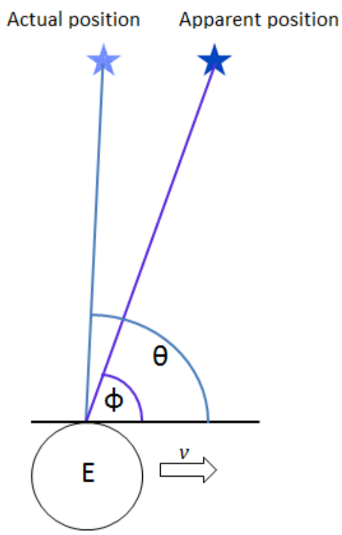

Figure 10.2: Apparent angle ϕ is less than actual angle θ.

In the classical explanation, the relationship between apparent angle and actual angle of the aberration of stars was figured out by using the classical formula of velocity-addition. Here, we show the result only [10.1]:

$$\tan\phi = \frac{\sin\theta}{\cos\theta + v/c}, \tag{10.1}$$

where v is the velocity of the Earth in its orbit around the Sun,

ϕ is the apparent angle, and θ is the actual angle.

10.2. Aberration of Light in the Special Theory of Relativity

In the early twentieth century, the famous scientist Albert Einstein, through his special theory of relativity, gave us a modified equation of the aberration of light by using the relativistic formula of velocity-addition instead of the classical one of that. Hence, the relativistic equation of aberration of light is similar to the classical equation 10.1, except, the appearance of the Lorentz factor gamma, γ [10.1]:

$$\tan\phi = \frac{\sin\theta}{\gamma(\cos\theta + v/c)}, \tag{10.2}$$

where $\gamma = (1 - v^2/c^2)^{-1/2}$,

v is the velocity of the light source,

ϕ is the apparent angle, and θ is the actual angle.

Equation 10.2 describes the relationship between the apparent angle and actual angle of a light source that is moving at a constant velocity (see figure 10.3) in the special theory of relativity.

Let us see what happens in case the light source moves straight toward the observer (actual angle $\theta = 0^o$), as follows:

In figure 10.3 below, we call distance L_{app} from the observer to the apparent position apparent distance and call distance L_{act} from the observer to the actual position actual distance.

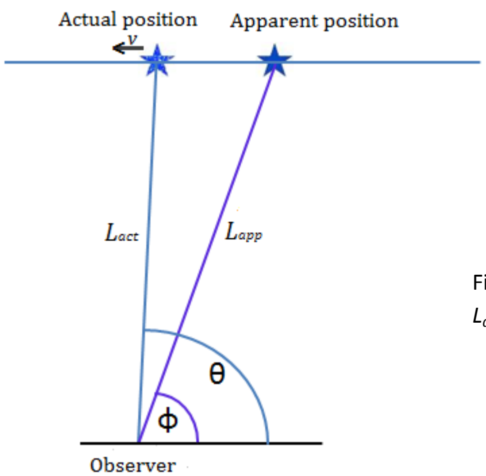

Figure 10.3: Actual distance L_{act} and apparent distance L_{app} from a moving light source to the observer.

By applying the law of sines to the triangle in the figure above, we obtain

$$\frac{L_{app}}{L_{act}} = \frac{\sin(180^0 - \theta)}{\sin\phi} = \frac{\sin\theta}{\sin\phi}.$$

Combining this equation with equation 10.2, we obtain

$$\frac{L_{app}}{L_{act}} = \frac{\gamma(\cos\theta + v/c)}{\cos\phi}. \tag{10.3}$$

In case actual angle θ approaches 0^o, we are able to figure out the value of $\tan\phi$ in equation 10.2 as follows:

$$\lim_{\theta -> 0^0} \tan\phi = \lim_{\theta -> 0^0} \frac{\sin\theta}{\gamma(\cos\theta + v/c)} = 0. \tag{10.4}$$

On the other hand, by using the definition of arctangent, we obtain

$$\lim_{\tan\phi -> 0} \phi = 0^0. \tag{10.5}$$

Combining two equations 10.4 and 10.5, we obtain

$$\lim_{\theta \to 0^0} \phi = 0^0. \tag{10.6}$$

Equation 10.6 means that apparent angle ϕ approaches 0^o as actual angle θ approaches 0^o. In other words, when the light source moves straight toward the observer, the apparent image of the light source appears to move straight toward the observer, as well. And we are able to figure out the ratio of the apparent and actual distances by using equation 10.3 as follows:

$$\lim_{\theta -> 0^0} \frac{L_{app}}{L_{act}} = \lim_{\theta -> 0^0} \frac{\gamma(\cos\theta + v/c)}{\cos\phi} = \gamma(1 + v/c) = \frac{1 + v/c}{\sqrt{1 - v^2/c^2}} = \sqrt{\frac{1 + v/c}{1 - v/c}}$$

$$\lim_{\theta -> 0^0} \frac{L_{app}}{L_{act}} = \sqrt{\frac{c + v}{c - v}}. \tag{10.7}$$

Equation 10.7 shows us a ratio of the apparent and actual distances of an object that is moving straight toward an observer at a constant velocity. This ratio has been derived from the relativistic equation of aberration of light in the special theory of relativity.

10.3. Apparent Image and Actual Position

Let us consider the following conceptual experiment:

There are two points, A and B, on a line L in free space. A spaceship is flying along the line at a constant velocity *v* toward the two points. A lamp is placed at point B, and an observer is standing at point A, as illustrated below:

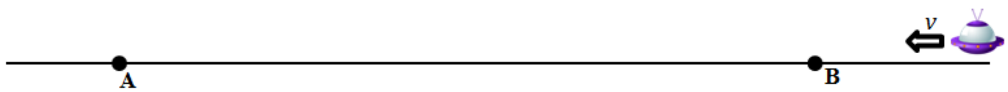

Figure 10.4: A spaceship is flying along line BA.

At 0 seconds, the spaceship passes point B, emitting a red light signal which carries the spaceship's image. At the same time, the lamp emits a blue light signal which carries the lamp's image, as illustrated below:

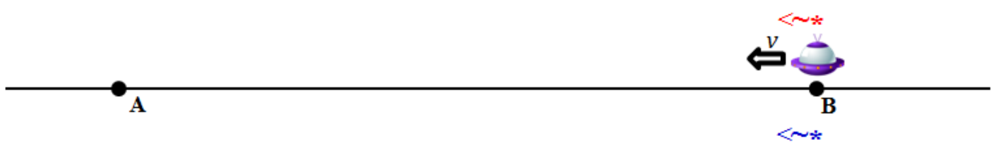

Figure 10.5: At 0:00, the spaceship and the lamp emit light signals at point B.

It always takes time for photons emitted from a distant light source to propagate to us, and we see the image of the light source as these photons contact our eyes. When the light source is moving, we see the light source appear at the position where the photons were emitted. We call this position apparent position. At the time those photons reach us, the light source has already moved to another position, and we call this position actual position. This situation is illustrated in figure 10.6 as shown below:

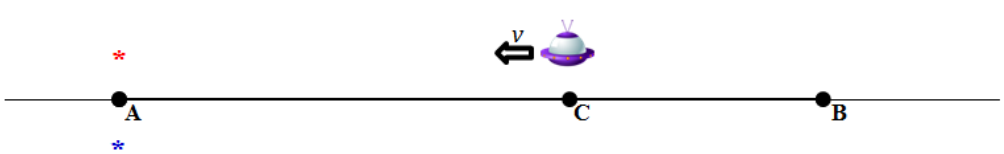

Figure 10.6: At time t, the observer sees both light sources appearing at point B. At the same time the spaceship passes point C.

As we know, the speed of light is constant in free space. This constancy means that the speed of light does not depend on the velocity of light sources. Hence, both the light signals that are emitted at point B at 0 seconds would arrive point A and contact the observer's eyes simultaneously at time t, t = AB/c. In other words, at time t the observer would see both images of the spaceship and the lamp appearing simultaneously side by side at point B [10.2]. We call the spaceship's image that the observer sees apparent image, and call distance AB between the observer and the apparent image apparent distance. During the time period between 0 seconds and time t, the spaceship moves toward point A and passes point C at time t. We call distance AC between the observer and the spaceship actual distance. The ratio of the apparent distance and actual distance is

$$\frac{AB}{AC} = \frac{AB}{AB - BC} = \frac{ct}{ct - vt}$$

$$\frac{AB}{AC} = \frac{c}{c - v}, \tag{10.8}$$

where c is the speed of light, and v is the velocity of the spaceship.

Equation 10.8 shows us a ratio of the apparent and actual distances of an object that is moving straight toward an observer at a constant velocity. This ratio has been derived directly from the constancy of the speed of light. We are aware that equation 10.7 is different from equation 10.8. This difference indicates that the special theory of relativity is *inconsistent* with the constancy of the speed of light.

3. Conclusion: This inconsistency is sufficient for us to claim that the special theory of relativity is not right regardless of what the results of real experiments are. If real experiments confirm equation 10.8, then the special theory of relativity is not correct. If real experiments refute equation 10.8 then the speed of light is not constant and the special theory is also not right.

Endnotes

[10.1] https://en.wikipedia.org/wiki/Aberration_of_light

[10.2] The claim “the observer would see both images of the spaceship and the lamp appearing simultaneously side by side at point B” is not only a logical argument but is confirmed by the results of observations of binary stars.

https://en.wikipedia.org/wiki/De_Sitter_double_star_experiment