

## Einstein's Aberration Formula

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**Abstract:** Aberration of starlight is one of the most important physical phenomena, remaining unexplained until now. A misunderstanding of it led Einstein to the idea of a variable time, the flow of which could be influenced by mere exchange of mathematical observing systems without any physical action. In his work "On the electrodynamics of moving bodies" Einstein gave an aberration formula without proof, which is geometrically incorrect [1]. In 1907 he changed the description of the formula but not the formula [2]. Because the aberration of light can explain all apparent "relativistic" phenomenon it is very important to understand its true causes.

The illustration 1 shows that  $\cos \varphi'$ , the length ratio of EA and EB and thus the correct formula is:

$$\cos \varphi' = \frac{c \cdot \cos \varphi - v}{\sqrt{c^2 + v^2 - 2cv \cdot \cos \varphi}} = \frac{\cos \varphi - \frac{v}{c}}{\sqrt{1 + \frac{v^2}{c^2} - 2\frac{v}{c} \cos \varphi}},$$

or

$$\tan \varphi' = \frac{c \sin \varphi}{c \cdot \cos \varphi - v}$$

while Einstein gives for the relationship of EA and CB:

$$\cos \varphi' = \frac{\cos \varphi - \frac{v}{c}}{1 - \frac{v}{c} \cos \varphi} = \frac{c \cdot \cos \varphi - v}{c - v \cdot \cos \varphi}.$$

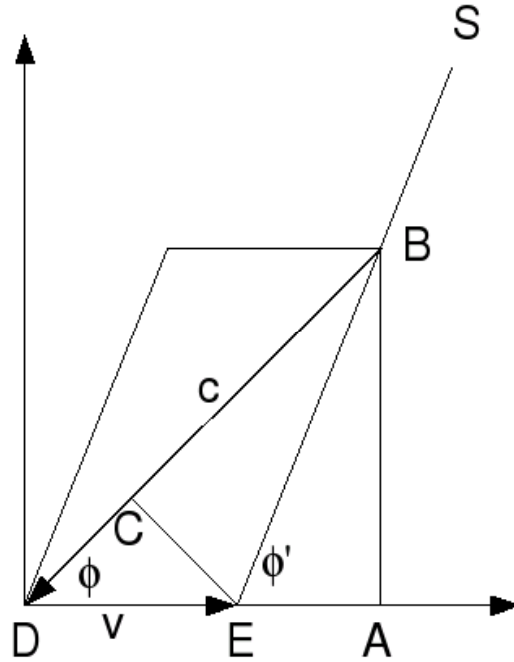
It is physically impossible that a velocity can be identical in two coordinate systems moving with different speeds, which unmistakably clarifies illustration 1. Here, one sees that the speeds of light in both ether systems correspond to the movement of the intersection point of the distances BD and BE. Thus it is explicitly clear that the speed of light is reduced in relation to the star after entering the ether system of the earth, because the speed of light must adapt to each optical medium. One determines the speed of light in the ether system of the earth related to the so-called inertial system of the star by the cosine law:

$$c' = \sqrt{c^2 + v^2 - 2cv \cdot \cos \varphi}$$

and thus because of momentum conservation, the Doppler frequency change:

$$\frac{hf_1}{c} = m_1 c = m_2 \sqrt{c^2 + v^2 - 2cv \cdot \cos \varphi} = \frac{hf_2}{c^2} \sqrt{c^2 + v^2 - 2cv \cdot \cos \varphi},$$

$$f_2 = f_1 \frac{c}{\sqrt{c^2 + v^2 - 2cv \cdot \cos \varphi}}.$$



**Illustration 1:** Geometrical conditions regarding the computation of the aberration of the light according to Einstein. The ray of light travels along distance SE, enters the moving ether system at point B and is slowed down by the speed of  $c$  relative to the ether. The ray of light does not thereby change its direction, since the massy photons cannot be diverted by a massless medium. That means, the light front moves with the intersection point of the distances BE and BD.

For small speeds, the radical can be developed using the Taylor series and one receives a simple formula for the universal Doppler effect:

$$f_2 = \frac{f_1}{1 - \frac{v}{c} \cdot \cos \varphi}.$$

This result can be applied for example, to a moved electron, because there are no substantial differences between light and the electromagnetic field. It is well known that both are only different manifestations of the same physical reality. With consideration of the principle of the constancy of the relative medium-specific speed of light, the frequency change of all field quanta of the electron can be computed:

$$F_2 = \frac{F_1}{\pi} \int_0^\pi \frac{d\varphi}{1 - \frac{v}{c} \cdot \cos \varphi} = \frac{F_1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

and the mass of moving electron is:

$$m_e(v) = \frac{m_e(v=0)}{\sqrt{1 - \frac{v^2}{c^2}}} .$$

This view shows that the apparent mass increase of the electron is a consequence of the Doppler effect of the electromagnetic field or the field quanta of the electron. A proof of the Doppler effect of the electromagnetic field is in the well-known phenomenon of Cherenkov radiation. It is also very naive to accept that the mass of the electron would become infinitely large with  $v=c$ .

### References

1. A. Einstein: "Zur Elektrodynamik bewegter Körper". *Annalen der Physik* **17**, 891-921, (1905).
2. A. Einstein: „Über das Relativitätsprinzip und die aus demselben gezogene Folgerungen“, *Jahrbuch der Radioaktivität und Elektronik* **4**, 411-462, (1907).