the general science journal

Aberration of Light and the Principle of Conservation of Linear Momentum

Copyright © Emil Falkner
e.falkner@online.de

Abstract: It is well known that the theory of locally dragged ether by massive bodies can also explain the results of Michelson-Morley experiment. The small shift of interference fringes, measured by Michelson and Morley, is caused by the change of speed of light due to earth's rotation which is about hundred times smaller than the expected speed of orbital motion. The aberration of light was regarded as the main argument against the explanation of the Michelson-Morley experiment. But if the particle character of light is taken into account, this argument can also be rejected – the propagation direction of a massive particle cannot be changed by the motion of a non-massive ether medium.

Aberration of light

The phenomenon of the aberration of light was discovered 1725 by James Bradley [1], during his observations of the star, gamma Draconis and was also interpreted correctly as an apparent shift of the star position due to the finite speed of light relative to the lumineferous ether. Up to the attempt of Michelson and Morley [2], during which practically no relative motion between earth and the lumineferous ether could be determined, this explanation of the aberration of light was also generally accepted. Later attempts to explain the aberration of light and the results of the Michelson and Morley experiment by a uniform physical theory led finally to the introduction of relativity theory [3, 4], although the possibility of a gravitation-conditioned ether carrier was considered at the same time [5, 6, 7].

It is easily comprehensible that the lumineferous ether must be carried by gravitation strength, since in a gravitational field, all objects are accelerated independent of mass. It does not give any reason why the acceleration law for particles with $m \to 0$ should not be valid in the same way, since along with others, Einstein had shown that each electromagnetic energy possesses mass [8], which must be accelerated by gravitation strength. At the same time it is clear that the lumineferous ether cannot be rotated by spherical bodies like earth because of the absence of tangential force.

If the earth moves with a speed of v relative to the star and if v stands perpendicularly on the connecting line between star and earth ($\gamma = \pi / 2$ in fig. 1), the angle of inclination can be computed from the right-angled triangle of the Pythagorean theorem:

$$\tan \phi = \frac{v}{x} = \frac{v}{\sqrt{c^2 - v^2}} = \frac{v/c}{\sqrt{1 - v^2/c^2}} .$$

One receives the Lorentz factor and/or the relativistic root which is nothing but the Bradley's cosine function [1]. Since the speed of light must always be *c* in the field-free ether, it is obvious that each ether movement must cause a change of energy in the arriving photons. Simplified, the star and earth's system can be understood as two spatially separated closed inertial systems, i.e. two masses within the moving ether atmosphere. Accordingly, such systems must be regarded as physically

isolated, whereby within respective spatial system borders, all physical processes run off in the same way and independent of the motion of the observer, as long as this exercises no physical effect on the system. That is, the physical procedures are dependent only on the physical characteristics of respective system whether an observer is moved relatively to the system or not.

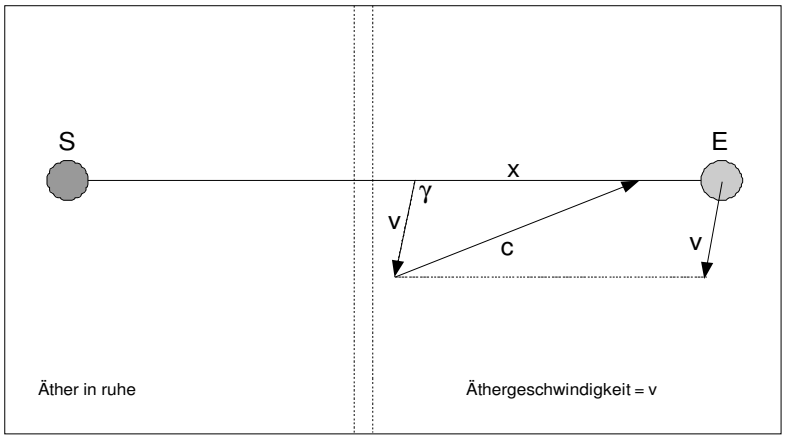

Figure 1: A ray of light comes from a fixed star S to earth E moving with speed v. The broken lines indicate the boundaries of the ether fields moving with two large masses.

If a ray of light propagating in an ether system, arrives to another relative to this moving ether system, its speed adapts to the "new" system by a change of energy (red/blue shift). Thus, the movement of the ether and the movement of the photon add up again to the total speed of c relative to "new" ether. That means, by the movement of the "transmitter", the direction of propagation of the ray does not change relative to transmitter.

It is likewise unmistakable that the photons cannot be diverted by the movement of the ether, because the principle of conservation of linear momentum must always and everywhere be valid [5, 6, 7]. Since the mass of the ether particles is infinitesimally small, their momentum must also be infinitesimal small:

$$p_{ether} \to 0\,,$$

while the momentum of photon is

$$p_{photon} = m_{photon} \cdot c >> 0\,.$$

This means that the ray of light as seen by the "emitting system " always keeps a straight-line movement (thus in fig. 1 along x), independently of how the ether fields move against each other. At the same time it becomes evident that the speed of the ray of light changes relative to the emitting system, since the photons cannot exceed the vacuum speed of light relative to the new moving ether.
In this case, the speed of light observed by the emitting system, if v and c are perpendicular to each other amounts to:

$$C = \sqrt{c^2 - v^2}\,.$$

In the moving system, the ray of light receives a speed component, which corresponds to the system speed $-v$. This is reversed if the star is regarded as moving and the earth at rest. Then it is

plausible that a momentum component is given to the photon by the star's movement, which determines the direction of the photon in the earth system. That means, in the moving system, the ray of light moves further with the speed of light along the longer side of the triangle (fig.1). Thus it becomes immediately evident that the Lorentz factor is not justified in "relativistic time", but has its cause in the actually modified speed of light relative to the source of light, but equals *c* relative to the new ether (of the observer system along which it moves). Since the momentum must remain the same in any case, the expression for the mass of the photon in the moving ether results from the above view if *v* is perpendicular to *c*:

$$p_1 = p_2; m_1 c = m_2 \sqrt{c^2 - v^2}; m_2 = \frac{m_1}{\sqrt{1 - \frac{v^2}{c^2}}}.$$

Since the mass is defined relative to the respective ether it is valid:

$$m_1 = \frac{hf_1}{c^2}; m_2 = \frac{hf_2}{c^2}; \frac{f_1}{f_2} = \sqrt{1 - \frac{v^2}{c^2}}$$

and

$$p_1 = \frac{hf_1}{c} = \frac{h}{\lambda_1}; p_2 = \frac{hf_2}{c}\sqrt{1 - \frac{v^2}{c^2}} = \frac{h}{\lambda_2}\sqrt{1 - \frac{v^2}{c^2}}.$$

If the earth moves against the star or moves away from the star, the photons coming from the star must be braked and/or accelerated to speed *c* relative to the earth's ether. Under the principle of conservation of linear momentum, the expressions for the mass of the photon in the reference system of earth's ether result in:

$$m_2 = m_1\left(1 + \frac{v}{c}\right) \text{ bzw. } m_2 = m_1\left(1 - \frac{v}{c}\right).$$

Likewise, it is valid for photons in translucent media (n is refractive index in the medium):

$$m_2 = m_1 \frac{cn}{c} = m_1 n.$$

As an explanation, one can regard rays of light similar to rain drops, since they also fall diagonally to a moving object. It is wrong in this view, because in this case the speed of light would be larger related to the observers than the wave velocity in the transmitting medium:

$$c(v) = \sqrt{c^2 + v^2} = c\sqrt{1 + v^2/c^2}.$$

This dependence of the speeds is valid in the case that an observer moves with a speed *v* through the ether (e.g. an observer in the airplane, if the source of light is on the ground). The same is valid for acoustic waves and moving observers in a fixed medium (air). However, the medium moving with the object, e.g. air in a closed car and the acoustic wave coming from outside, the relative speed of sound amounts to: $c(v) = \sqrt{c^2 + v^2}$ outside and $c(v) = c$ in the car's interior. This view, transferred to the systems of star-ether and earth-ether means that the speed of light in the star system related to the earth system is in the special case of perpendicular velocities: $c(v) = c\sqrt{1 + v^2/c^2}$.

The consequence: The moving ether systems, i. e. the astronomical bodies with the moving ether environments are “the relativistic“ spatially limited inertial systems, in which the speed of light is constant only relative to this astronomical body. Each movement in these systems, can be regarded as a movement relative to the fixed ether. Thus the negative result of Michelson-Morley experiment, but positive result of Michelson-Gale and Sagnac experiment can be regarded as a confirmation of the ether theory of Maxwell.

References

1. James Bradley: ”Account of a new discovered motion of the fixed stars“. Phil. Trans. R. Soc. (London) **35,** 637-661, (1728).

2. Albert A. Michelson, Edward W. Morley: ”On the Relative Motion of the Earth and the Luminiferous Ether“. American Journal of Science **34,** 333-345, (1887).

3. Hendrik A. Lorentz: ”Versuch einer Theorie der electrischen und optischen Erscheinungen in bewegten Körpern“ (Verlag E.J. Brill, Leiden, 1895).

4. Albert Einstein: ”Zur Elektrodynamik bewegter Körper“. Annalen der Physik **17,** 891-921, (1905).

5. E. Gehrcke: "Über den Äther" (1918) in *Verhandlungen der Deutschen Physikalischen Gesellschaft* **20,** 165-169. (1918)

6. K. Vogtherr: Naturwissenschaftliche Wochenschrift **21**, 17, (1922)

7. K. Vogtherr: Astronomische Nachrichten **222**, 209-222, (1924).

8. A. Einstein: ”Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig“. Annalen der Physik **18,** 639-641, (1905).