the general science journal

Classical Ether Theory Explains the Fizeau Experiment

Copyright © Emil Falkner
e.falkner@online.de

Abstract: Regardless of the fact that A. Michelson and E. Morley explained the Fizeau Experiment [1, 2] in a very simple classical way [3], this experiment is sometimes used to demonstrate the validity of special theory of relativity[4]. Because some other experiments [5, 6] show that Doppler effect, which is generated within a moving Medium, influences the average speed of light, it could be rather interpreted as an argument against the special theory of relativity.

An attempt to measure the speed of light in moving water was accomplished in 1851 by H. Fizeau [1, 2], whereby it turned out that the addition of the speeds does not correspond to the usual composition of vector values. It was shown however that the measurements confirm the ether drag theory, whereby the ether is to be only partly carried. Since the speed of light is in a medium that is also frequency dependent, Fresnel's theory cannot completely be in this case free of errors. Later it was shown that the results of Fizeau experiment can be derived by use of the relativistic addition of the speeds, if it is limited to small speeds of the medium (M. Laue) [4], with the problem that relativistic addition of speeds is neither mathematically nor physically an addition but only a rule for the computation of a transcendental function of the sum of two numerical values. Thus the only possible physical explanation remains still the theory of the gravitationally carrying ether [7, 8, 9], which also explains the zero-result of the Michelson Morley experiment. This theory appears completely plausible, due to the fact that a mass can be assigned to the ether as soon as an electromagnetic field is applied. It is obvious that everywhere in the space, an electromagnetic field must be present because electromagnetic radiation of different wavelengths constantly thwarts each point of the universe. Also A. Einstein deduced a relationship between mass and electromagnetic energy [10].

Because the moving water possesses, compared with earth, an infinitesimally small mass, thus gravitatational carrying of the ether by water is not possible. It must proceed from the conception that in water, two different speeds are to be considered: The speed of light c in the empty gaps, in which electrons has no influence on light and an (average) speed of light, which is completely bound to matter (electron clouds). Obviously only the speed of light in the matter portion can be affected by movement, while the speed in the non-material massless gaps remains unchanged. Thus the time, which is necessary for light to pass a distance of length L in the water, can be simply computed. For the water at rest, we can write:

$$\frac{L}{c'} = \frac{L_1}{c''} + \frac{L_2}{c}.$$

L_1 is the material (ponderable) distance portion, i.e. the sum of all molecular ranges of the optical path, which interacts with the ray of light, L_2 is the uninfluenced ether portion of the optical path and it is: $L_1 + L_2 = L$. By division of both sides of the above equation by L one receives:

$$\frac{1}{c'} = \frac{x}{c''} + \frac{1-x}{c} = \frac{n}{c} \ ,$$

whereby $\frac{L_1}{L}$ and $\frac{L_2}{L}$ through x and $1-x$ were replaced.

After transforming the equation an expression for the refractive index of the medium results:

$$c' = \frac{c}{x\left(\frac{c}{c''}-1\right)+1} \Rightarrow n = x\left(\frac{c}{c''}-1\right)+1 .$$

The average speed of light in a medium is obviously a simple combination of two speeds, which are calculated in a conventional way.

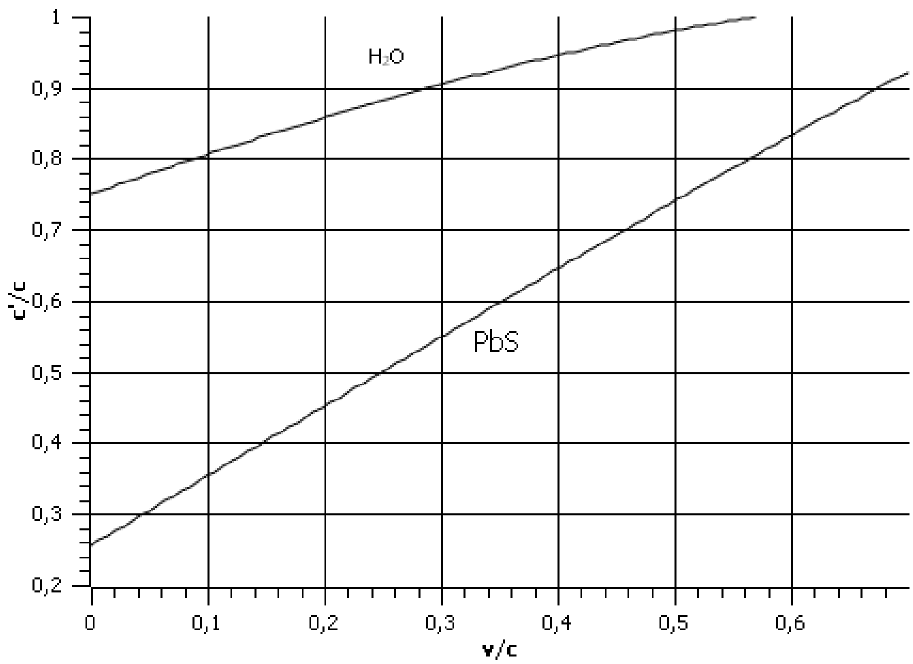

Figure 1: Dependence of the relative speed of light in the moved medium according to the theory of the locally carried ether.

In case of the flowing water, the material (ponderable) portion of the path moves with the speed of *v*, so that only in this distance portion a full carry of rays of light takes place, while in the ether portion the ray of light is not influenced.

In this way one receives the equation for the moved medium (A. Michelson and E. Morley 1886) [3]:

$$t = \frac{x}{c''} + \frac{1-x}{c-v},$$

$$L' = 1 + \frac{x}{c''}v + \frac{1-x}{c-v}v,$$

$$c' = \frac{L'}{t} = \frac{1}{\frac{x}{c''} + \frac{1-x}{c-v}} + v\,,$$

$$c' = \frac{c-v}{x\left(\frac{c-v}{c''} - 1\right) + 1} + v\,.$$

One sees immediately that this equation is for small speeds similar to the linear Fresnel carrying formula and for *v=0* turns into the equation for water at rest. At the speed of the medium $v = c - c''$, the speed of light is in the medium, equal to the vacuum speed of light (fig. 1). Both unknown quantities (c'' and *x*) in these equations can be approximately determined by a linear extrapolation ($c' = c$) of Fresnel's equation:

$$c' = c = \frac{c}{n} + v\left(\frac{n^2 - 1}{n^2}\right).$$

From this, the speed *v* results, at which the speed of light in the moving water is equal to the speed of light in the vacuum:

$$v = \frac{cn}{n+1}$$

and from it:

$$c'' = \frac{c}{n+1}\,;\; x = \frac{n-1}{n}\,.$$

A test shows that the equation for the resting medium is fulfilled with these values. It must be noted however that these values are only approximates, which must be dependent on the relative speed of the medium in relation to the ether, because interactions between moving electrical charges and the ether, influence the effective mass of the electrons of medium. That means, the refractive index *n* must be likewise speed dependent, whereby still, the microscopic "Doppler effect" is to be considered (dispersion).

For small speeds, the equation for the moving medium can be simplified and one receives a formula, which appears to be more exact than Fresnel's formula, because for $x = 1$, a full carrying of the light arises [3]:

$$c' \approx \frac{c}{n} + v\left(\frac{n^2 - 1}{n^2} + \frac{x}{n^2}\right).$$

This simple view shows that the Fizeau experiment can be explained by application of the ether theory completely without contradiction and without further auxiliary assumptions. In addition, this equation is valid for arbitrary, physically permissible speeds of the medium, therefore the result of the experiment cannot be interpreted as a confirmation of special relativity theory.

A year later, Michelson and Morley tried to measure the movement of the earth relative to an ether absolutely at rest [11]. It was shown however, that the earth rests relative to the ether or is moved with a hardly measurable speed, which can be regarded together with the result of the Fizeau experiment as a further confirmation of the theory of the locally carried ether.

References

1. H. Fizeau : "Sur les hypothèses relatives à l'éther lumineux". Comptes Rendus **33**: 349–355, (1851)

2. H. Fizeau: "Sur les hypothèses relatives à l'éther lumineux". Ann. de Chim. et de Phys. **57**: 385-404, (1859)

3. A. Michelson, E. Morley: "Influence of Motion of the Medium on the Velocity of Light," American Journal of Science, 3rd, Vol. **31**,185, (1886)

4. M. Laue: "Die Mitführung des Lichtes durch bewegte Körper nach dem Relativitätsprinzip". Annalen der Physik **23**: 989-990, (1907)

5. P. Zeeman: "Fresnel's coefficient for light of different colours. (First part)" Proc. Kon. Acad. van Weten. **17**: 445-451, (1914)

6. P. Zeeman: "Fresnel's coefficient for light of different colours. (Second part)" Proc. Kon. Acad. van Weten. **18**: 398-408, (1915)

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

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

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

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

11. A. Michelson, E. Morley: "On the Relative Motion of the Earth and the Luminiferous Ether". American Journal of Science **34** 333-345, (1887)