Journal of Physical Mathematics
ISSN: 2090-0902
Gennadiy and Vitali, J Phys Math 2017, 8:1
DOI: 10.4172/2090-0902.1000207
Research Article
OMICS International

Optical Fizeau Experiment with Moving Water is Explained without Fresnel's Hypothesis and Contradicts Special Relativity

Gennadiy S* and Vitali S
Independent Researcher, Sverdlovsk Oblast, Yekaterinburg, 620062, Russia

Abstract

Fizeau experiment actually proves not partial, as the special relativity asserts, but complete dragging of the light by moving medium. The decrease of the fringe shift in the Fizeau's two-beam interferometer is explained not with wrong Fresnel's aether drag hypothesis but with the phase deviations arising in the interfering beams because of Doppler shift of the frequencies. Fizeau experiment does not prove but, on the contrary, refutes Einstein's theory of relativity.

Keywords: Fresnel; Doppler; Interferometer

Introduction

200 years ago, Fresnel, trying to explain results of the optical Arago's experiments by the aether wave hypothesis, suggested that a moving at speed V medium drags the light only partially and the speed of the light changes by drag coefficient $V\left(1-\frac{1}{n^2}\right)$. To test this hypothesis, in 1851 Fizeau carried out interference experiment with moving water.

At the speed of the water V=7,059 m/s, the length of pipe L=2.974 m,

The length of light wave $\lambda_0=526\cdot10^{-9}$ m and refraction index n=1.33,

He expected to receive the fringe shift 0.47099 in the case if the light was completely dragging by moving water. However, the shift in the experiment was less and equal to 0.23, that is it differed almost by $\left(1-\frac{1}{n^2}\right)=0.4346$ [1,2]. Although that time Doppler has already showed that the light changes its frequency when enters moving medium, Fizeau did not tried to explainn that result somehow differently and decided that he confirmed Fresnel's aether drag hypothesis about partial dragging of the light by moving medium.

In 1886 Michelson and Morley repeated Fizeau experiment and with higher accuracy confirmed the decrease of the fringe shift in moving medium. Taking into account the dispersion of the medium, Lorentz derived a formula for the drag coefficient. To confirm this formula, Zeeman in experiments with moving water and Harres in the experiment with the linearly moving quartz cylinder determined drag coefficients for the red and green light. However, as we know, in the calculation of the interferometer with moving water, nobody investigated and nobody considered the change of the the frequencies and the phase deviations, arising in interfering beams when they enter into moving water [3].

The erroneous explanation of Fizeau's experiment, a significant role of which in the creation of the special relativity was repeatedly emphasized by Einstein, is still considered as one of the most important confirmation of the special relativity [1].

As shown below, the beams in Fizeau interferometer travel at speeds $\left(\frac{C}{n}+V\right)$ and $\left(\frac{C}{n}-V\right)$ that is complete but not partial dragging takes place. The fringe shift is less than 0.47099 not because of Fresnel's hypothesis about "partial dragging" but because of phase deviations arising in interfering beams in moving water and therefore Fizeau experiment does not confirm but, on the contrary, disproves special relativity.

The Conventional Calculation of the Fizeau Interferometer

In Fizeau interferometer, the beam 1 travels in direction of moving water and the beam 2 travels toward moving water. Instead real scheme of Fizeau interferometer in which the beams travel in the same pipe and pass the same distance L in opposite directions, we consider more simple equivalent scheme explained in Figure 1, where the beams 1 and 2 pass identical distances $\left(\frac{C}{n}-V\right)$ in two pipes in which water moves at speed V in opposite directions. Just as in the experiment Fizeau, photons exit from moving water at the same distance from the screen, as in immovable water. At the moment t=0, the photons of the frequency ν_0 with identical initial phase equal to zero simultaneously enter in both pipes. If water is at rest, photons travel with identical frequency ν_0 and speed $\frac{C}{n}$, pass the distances L for identical time $t_0=\frac{Ln}{C}$ and interference fringes are in initial position.

t_0=1.3193860934286745799322276479684e-8

When water moves at speed V, the speeds of the photons and their frequencies change.

In the beam 1, photons move at speed $\frac{C}{n}$ relative to water and at

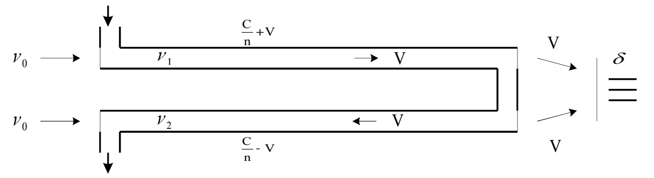

Figure 1: Movement of photons at C/n relative speed.

***Corresponding author:** Gennadiy S, Independent Researcher, Sverdlovsk oblast, Yekaterinburg, 620062, Russia, Tel: 24956484; E-mail: sokolovg@yahoo.com, vitali@sokolovrealty.com

Received July 04, 2016; **Accepted** December 30, 2016; **Published** Janaury 05, 2017

Citation: Gennadiy S, Vitali S (2017) Optical Fizeau Experiment with Moving Water is Explained without Fresnel's Hypothesis and Contradicts Special Relativity. J Phys Math 8: 207. doi: 10.4172/2090-0902.1000207

$\frac{C}{n}+V$ relative to pipe. They pass the distance L for the time $t_1=\frac{L}{\frac{C}{n}+V}$ less than t_0,

$\left(\frac{C}{n}+V\right)$=225407870.21689473684210526315789

t_0=1.3193860521100355077861729804249e-8

For the time t_1, every photon passes relative to water the distance $L_1=\frac{C}{n}t_1=\frac{LC}{n\left(\frac{C}{n}+V\right)}$ less than L.

L_1=2.973999906864538581552593505374

In the beam 2, photons move at speed $\frac{C}{n}$ relative to water and at $\left(\frac{C}{n}-V\right)$ relative to pipe. They pass the distance L for the time $t_2=\frac{L}{\frac{C}{n}-V}$ more than t_0

$\left(\frac{C}{n}-V\right)$=225407856.09889473684210526315789

t_2=1.3193861347473162399940564872283e-8

For the time t_2 every photon passes relative to water the distance $L_2=\frac{C}{n}t_2=\frac{LC}{n\left(\frac{C}{n}-V\right)}$ more than L.

L_2=2.9740000931354672518130533811804

Photons of the beam 1 come to the screen earlier than photons of the beam 2 and the fringes shift in interferometer.

In usual two-beam interferometers, the interfering beams pass the distances with identical frequency ν_0 and the fringe shift is determined simply by the difference of the times : $\Delta t=t_2-t_1$

$$\delta_V=\frac{C\Delta t}{\lambda_0}=\frac{C(t_2-t_1)}{\lambda_0}=\frac{LC}{\lambda_0\left(\frac{C}{n}-V\right)}-\frac{LC}{\lambda_0\left(\frac{C}{n}+V\right)}=\frac{2LVC}{\lambda_0\left(\frac{C}{n}+V\right)\left(\frac{C}{n}-V\right)} \quad (1)$$

If L=2.974 m, C=299 792 458 m/s, V=7,059 m/s, $\lambda_0=526\cdot10^{-9}$ m and n=1.33, the expression (1) gives a value of the fringe shift δ_V=0.471

Δt=0.00000000826372807322078835068034

δ_V=0.47098923028792093466696294582087

Such fringe shift, according to the Fizeau, should be in his interferometer. But in experiment the fringe shift was less than 0.471 and equal to 0.23.

The Change of the Frequencies in Moving Water

In Fizeau interferometer, the light is completely dragged by moving water. But because the beams enter the moving water from immovable light source, in accordance with Doppler effect, their frequencies change and an observer moving together with water will see different frequency. Additional phase deviations arise in interfering beams. Because of these deviations, the resulting fringe shift in the interferometer with moving water cannot be determined by the expression (1) and is less than δ_V=0.471.Photons of the beam 1 entering moving water with a speed V change the frequency from ν_0 to $\nu_1=\nu_0\left(1-\frac{V}{C}\right)$ and with speed $\frac{C}{n}$ and frequency $\nu_1<\nu_0$ pass relative to water the distance L_1. At the moment t_1 they exit from moving water changing the frequency from ν_1 to $\nu=\nu_1\left(1+\frac{V}{C}\right)=\nu_0\left(1-\frac{V}{C}\right)\left(1+\frac{V}{C}\right)=\nu_0\left(1-\frac{V^2}{C^2}\right)$. Photons travel in air to the screen with the speed C and frequency $\nu=\nu_0\left(1-\frac{V^2}{C^2}\right)$ and interfere with photons of the beam 2.

Photons of the beam 2 entering moving water change the frequency from ν_0 to $\nu_2=\nu_0\left(1+\frac{V}{C}\right)$ and with speed $\frac{C}{n}$ relative to water and frequency $\nu_2>\nu_0$ pass the distance L_2. At the moment t_2 they exit from moving water changing their frequency from ν_2 to $\nu=\nu_2\left(1-\frac{V}{C}\right)=\nu_0\left(1+\frac{V}{C}\right)\left(1-\frac{V}{C}\right)=\nu_0\left(1-\frac{V^2}{C^2}\right)$. In the air photons travel to the screen with the speed C and frequency $\nu=\nu_0\left(1-\frac{V^2}{C^2}\right)$ and interfere with photons of the beam 1.

The Change of the Distances between the Wave Fronts

Besides the fact that photons change their frequency in moving water, the distances between the wave fronts change too, which leads to an additional change of resultant fringe shift.

When photons enter the pipe with immovable water Figure 2a, they do not change frequency and travel with frequency ν_0 and wavelength $\frac{\lambda_0}{n}=\frac{C}{n}T_0$.

Photons also do not change frequency if to suppose that the source S moves in interferometer together with water (Figure 2b). Moving with water, the observer will see the same frequency ν_0 and wavelength $\frac{\lambda_0}{n}=\frac{C}{n}T_0$.

In the case when the source S is at rest relative to pipe Figure 2c frequencies of the photons change but the same time the distances between the wave fronts change too. Moving with water, the observer will see that the beam changes in water not only its frequency but, depending on the direction of water movement, it "stretches" or "contracts".

In all situations, photons travel relative water at speed $\frac{C}{n}$ and for the time $T_0=\frac{1}{\nu_0}$ each wave front passes the distance in water $\frac{C}{n}T_0$. In

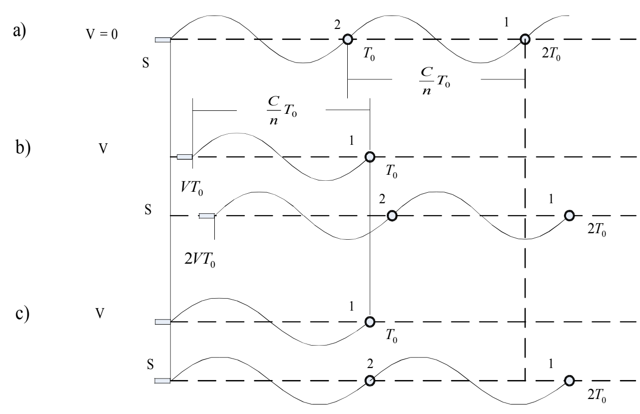

Figure 2: Illustrating the Movement of Photons at a travel speed $\frac{C}{n}+V$.

both pipes with moving water as shown in Figure 2b and 2c, photons are dragged completely and travel at speed $\frac{C}{n}+V$. For each period T_0, they are ahead at identical distances VT_0 relative to photons in pipe with immovable water.

In the pipe Figure 2b where the source moves together with water, photons travel with frequency ν_0 and the distances between the wave fronts are equal to wavelength $\lambda_0 = \frac{C}{n}T_0$.

In the pipe Figure 2c photons change frequency and travel in water with frequency ν_1 less than ν_0. For the time T_0, each wavefront passes relative to water the distance $\frac{C}{n}T_0$. Because water moves at speed V, at the moment T_0, when next wave front enters water, previous wavefront is at the same distance $\left(\frac{C}{n}+V\right)T_0$ as the wave front in Figure 2b. Though photons travel with frequency ν_1, the distance between the wave fronts is $\left(\frac{C}{n}+V\right)T_0$ but not $\left(\frac{C}{n}+V\right)T_1$. The distances are the same as in Figure 2b where photons travel with frequency ν_0. As shown below, because of the "stretching" or "contraction" additional phase shift arises and resulting fringe shift in interferometer changes.

Additional Fringe Shifts

Imagine that in the Fizeau interferometer, as well as in Figure 2, there is an additional pipe with immovable water, and consider propagation of photons in the pipes 1 and 2. The introduction of additional pipe simplifies analysis of the interferometer, as it allows to consider the motion of photons in each pipe separately, comparing the positions of the photons in the pipe with moving water with positions of the photons in the pipe with immovable water.

In usual two-beam interferometer, synchronous photons pass different distances with the same speed or the same distance with different speeds and therefore the fringe shift arises. Since synchronous photons travel with the same frequency and come to the screen with the same phase, the fringe shift can be determined by the difference $\Delta t = t_2 - t_1$ and is $\delta_V = \frac{C\Delta t}{\lambda_0}$.

In interferometer with moving water, because wave lengths and distances between wavefronts change, the fringe shift change and is less than δ_V.

The decrease of the fringe shift because of the wavelengths change

In Fizeau interferometer, the beam 1 and 2 travel with frequencies $\nu_1 = \nu_0\left(1-\frac{V}{C}\right)$ and $\nu_2 = \nu_0\left(1+\frac{V}{C}\right)$ and with different wavelengths. During the time while the beams travel in water, a phase deviation arises and because of it the fringe shift decreases.

In Figure 3, for example beam 1, it is shown the phase shift in the case when photons travel with different frequencies ν_0 and ν_1 and different wavelengths $\frac{C}{n}T_0 = \frac{\lambda_0}{n}$ and λ_1 in pipes with immovable water conditionally pipes are shown in dashed lines).

For one period $T_1 = \frac{1}{\nu_1}$ photons ν_1 of the same phase as photons ν_0 are behind at distance in water $\Delta\lambda_1 = \lambda_1 - \frac{\lambda_0}{n}$. Photons travel in

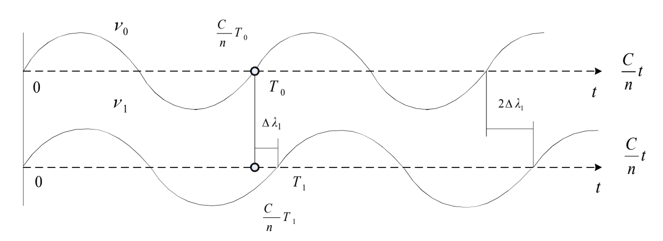

Figure 3: phase shift of photons traveling with the different frequencies.

both pipes with identical speed $\frac{C}{n}$. To the moment t_1 when they pass relative water the same distance L_1 and at the same time exit from water, between photons of identical phase the shift $\Delta\lambda_1 N_1$ accumulates, where $N_1 = \frac{t_1}{T_1} = \frac{L(C-V)}{\left(\frac{C}{n}+V\right)\lambda_0}$ is the number of oscillations in photons ν_1 for the time t_1. That is, at the moment t_1 when synchronous photons exit from water, photon ν_0 equivalent to photon ν_1 is behind in water at distance $\Delta\lambda_1 N_1$. In Fizeau interferometer, photons ν_0 also enter in imaginary pipe with immovable water. When water in the pipe 1 is at rest, photons exit from both pipes with identical frequency ν_0 and create interference fringes. When the water moves at speed V and photons travel with frequency ν_1 in pipe 1, the fringe shift is measured relative to these fringes. Interferometer works with frequency ν_0. It "does not know" that frequency changes in moving water and reacts with equivalent photon ν_0 which is behind in water at $\Delta\lambda_1 N_1$. During the time $\Delta t_1 = \frac{\Delta\lambda_1 N_1 n}{C}$ while equivalent photon passes in water the distance $\Delta\lambda_1 N_1$, synchronous photons exit from additional pipe and pass in air the distance $\Delta\lambda_1 N_1 n$. During the time Δt_1, шinterference fringes shift by:

$$\delta_{\lambda 1} = \frac{\Delta\lambda_1 N_1 n}{\lambda_0} \tag{2}$$

The fringes shift in interferometer as if photons pass the distance L_1 at a speed less than $\frac{C}{n}$.

The increase of the fringe shift because of the periods oscillations change

In Figure 4, also for example beam 1, a movement of the photons ν_1 in pipe 1 is compared with the movement of the photons ν_0 in pipe with immovable water. At the same time as the fringe shift decreases by $\delta_{\lambda 1} = \frac{\Delta\lambda_1 N_1 n}{\lambda_0}$, it increases by δ_{T1} because the distances between wave fronts ν_1 change and become less than wavelength $\lambda_1 = \frac{C}{T_0}$. Photons enter both pipes with identical phase which we assume to be zero. In pipe with immovable water, during the time T_0 photons pass the distance $\frac{C}{n}T_0$ equal to wavelength $\frac{\lambda_0}{n}$ and their phase changes by 2π. That is, wave fronts, whose phases differ by 2π travel at a distance $\frac{C}{n}T_0$ from one another which is equal to wavelength $\frac{\lambda_0}{n}$. In pipe 1 photons travel at speed $\frac{C}{n}+V$, frequency $\nu_1 = \nu_0\left(1-\frac{V}{C}\right)$ and period of oscillations $T_1 > T_0$. During the time T_1 they pass the distance

Citation: Gennadiy S, Vitali S (2017) Optical Fizeau Experiment with Moving Water is Explained without Fresnel's Hypothesis and Contradicts Special Relativity. J Phys Math 8: 207. doi: 10.4172/2090-0902.1000207

$\left(\frac{C}{n}+V\right)T_1$ but distance between wave fronts is less than their wavelength $\lambda_1=\frac{C}{n}T_1$. To the moment T$_0$ when first wavefront has not yet passed relative to water the distance λ$_1$ and is at distance $\left(\frac{C}{n}+V\right)T_0$ from the entrance in the pipe, next wavefront already enters the water.

The frequency with which wave fronts, with phases 2π,4π and so on, travel in water, is determined by the "clock" frequency ν$_0$ and therefore the distances between wave fronts are less than their wavelength $\lambda_1=\frac{C}{n}T_1$. Each wave front enters in moving water not at the moment T_1 but by (T_1-T_0) earlier. That is it instantly shifts relative to water forward at distance $\left(\frac{C}{n}+V\right)(T_1-T_0)$. Relative to water, each wave front passes during the time T$_1$ the distance which is by $\left(\frac{C}{n}+V\right)(T_1-T_0)$ less than λ$_1$.

During the time t_1, N_1 oscillations occur in the photons of the beam 1. Each wave front passes relative to water the distance which is by $\Delta_{T1}=N_1\left(\frac{C}{n}+V\right)(T_1-T_0)$ less than the distance L_1 which is passed by photons in additional pipe with immovable water shown in Figure 5.

Thus, for the time while photons in additional pipe pass the distance $\Delta_{T1,}$ photons exiting from pipe pass in the air the distance $n\Delta_{T1}$ and are ahead at$(n$-1) Δ_{T1}. That is, because of decrease of the distance passed in water by wave fronts of the beam 1, interference fringes additionally shift ahead by

$$\delta_{T1}=(n-1)\frac{\Delta_{T1}}{\lambda_0}=(n-1)\frac{N_1}{\lambda_0}\left(\frac{C}{n}+V\right)(T_1-T_0) \qquad (3)$$

Resulting fringe shift in Fizeau interferometer

The fringe shift in Fizeau interferometer with moving water is determined by three components:

$\delta_V=\frac{C(t_2-t_1)}{\lambda_0}$ - the fringe shift because of time difference $\Delta t=t_2-t_1$,

$\delta_\lambda=\frac{\Delta\lambda Nn}{\lambda_0}$ - the fringe shift because of change of the wavelengths,

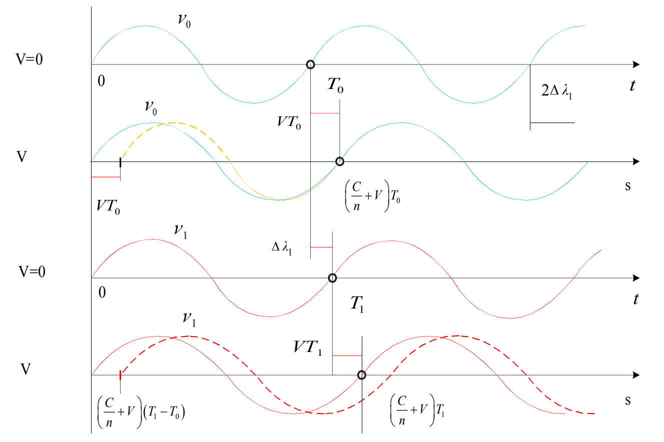

Figure 4: Comparison of Different movement of the photons.

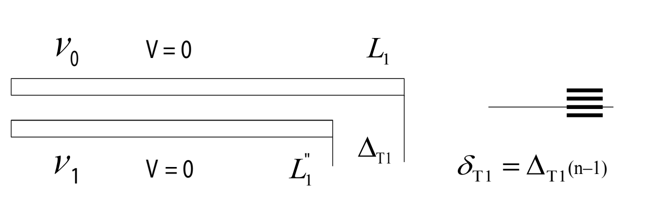

Figure 5: Illustration of photons in the additional pipe with fixed water.

δ_T - the fringe shift because of change of the periods T.

The same as above, we consider separately the movements of the photons in pipes 1 and 2 comparing them with the movement of the photons in pipe with immovable water and determine the fringe shifts and $\delta_1=\delta_{V1}-\delta_{\lambda1}+\delta_{T1}$ arising in the interfering beams.

Propagation of the Photons of the Beam 1 and the Fringe Shift δ$_1$

a) Photons of the beam 1 are completely dragged by moving water, travel at speed $\left(\frac{C}{n}+V\right)$ and come to the exit from water at the moment t_1 by $\Delta t_1=t_0-t_1=\frac{L}{\frac{C}{n}}-\frac{L}{\frac{C}{n}+V}=\frac{LV}{\frac{C}{n}\left(\frac{C}{n}+V\right)}$ earlier than in additional pipe.

Δ t_1=0.000 000 041 318 6390721460546675435 e-8 s.

Because of time difference Δt_1 the fringe shift δ_{V1} has to arise:

$$\delta_{V1}=\frac{\tilde{N}\Delta t_1}{\lambda_0}=\frac{LVn}{\lambda_0\left(\frac{C}{n}+V\right)} \qquad (4)$$

δ_{V1}=0.235 494 607 769 07804303774242284277

b) Photons of the beam 1 travel in moving water with frequency $\nu_1=\nu_0\left(1-\frac{V}{C}\right)$ and with wavelength $\lambda_1=\frac{C}{n}T_1=\frac{C}{n}T_0\left(\frac{C}{C-V}\right)=\frac{\lambda_0}{n}+\frac{\lambda_0 V}{n(C-V)}=\frac{\lambda_0}{n}+\Delta\lambda_1$ by $\Delta\lambda_1$ more than wavelength $\frac{\lambda_0}{n}$ in immovable water. During each period T_1 equivalent photons ν$_0$ are behind from photons ν$_1$ by $\Delta\lambda_1=\frac{\lambda_0 V}{n(C-V)}$. To the moment t_1 the delay $\Delta\lambda_1 N_1$ accumulates where $N_1=\frac{t_1}{T_1}=\frac{L(C-V)}{\left(\frac{C}{n}+V\right)\lambda_0}$ - the number of the oscillations in photons ν$_1$ during the time t_1.

$\frac{\lambda_0}{n}$=395.488 721 804 51127819548872180451e-9 m

λ$_1$=395.48873111680342716447776940105e-9 m

Δλ_1=0.000 009 312 2921489689890475965387218045 e-9 m

N_1=7 519 809. 473 373 336 3023147202804595

Δλ_1 N_1=70. 026 662 72637147740320263675333 e-9 m

While equivalent photons pass the distance $\Delta\lambda_1 N_1$ in water, photons ν$_0$ from additional pipe pass in the air the distance $\Delta\lambda_1 N_1 n$ and the fringe shift $\delta_{\lambda1}=\frac{\Delta\lambda_1 N_1 n}{\lambda_0}$ arises. Because of $\delta_{\lambda1}$, resulting fringe shift decreases as if photons of the beam 1 travel relative to water with the speed less than $\frac{C}{n}$.

$\delta_{\lambda 1}$=0.177 063 614 863 9684534118364081525

c) During each period T_1, wave front ν_1 instantly shifts relative to moving water at distance $\left(\frac{C}{n}+V\right)(T_1-T_0)$. During the time t_1 the shift $\Delta_{T1}=N_1\left(\frac{C}{n}+V\right)(T_1-T_0)$ accumulates and, because of this shift, wave fronts ν_1 are ahead by $(n-1)\Delta_{T1}$ relative to the wave fronts traveling in pipe with immovable water. Additional fringe shift δ_{T1} arises:

$$\delta_{T1}=(n-1)\frac{\Delta_{T1}}{\lambda_0} \quad (5)$$

Δ_{T1} =0.070 0 26 664 913 631 679 332 4149189172 e-6 m

δ_{T1} =0.043 933 078 748 095 920 493 720 386 392 92

Thus, photons of the beam 1 are completely dragged by moving water and interference fringes shift by

$\delta_1=\delta_{V1}-\delta_{\lambda 1}+\delta_{T1}$ =0.2354946-0.1770636+0.04393308=0.10236408

δ_1=0.102364

Propagation of the Photons of the Beam 2 and the Fringe Shift δ_2

a) Photons of the beam 2 are completely dragged by moving water, travel at speed $\left(\frac{C}{n}-V\right)$ and come to the exit from water at the moment t_2 by $\Delta t_2=t_2-t_0=\frac{L}{\frac{C}{n}-V}-\frac{L}{\frac{C}{n}}=\frac{LV}{\frac{C}{n}\left(\frac{C}{n}-V\right)}$ earlier than in additional pipe.

Δt_2=0.000 000 041 318 641 6600618288392599 e-8 s

Because of time difference Δt_1 interference fringes have to shift by

$$\delta_{V2}=\frac{\tilde{N}\Delta t_2}{\lambda_0}=\frac{LVn}{\lambda_0\left(\frac{C}{n}-V\right)}$$

δ_{V2} =0.235 494 622 518 842 891 629 220 7665748

b) Photons of the beam 2 travel in moving water with frequency $\nu_2=\nu_0\left(1+\frac{V}{C}\right)$ and with wavelength $\lambda_2=\frac{C}{n}T_2=\frac{C}{n}T_0\left(\frac{C}{C+V}\right)=\frac{\lambda_0}{n}-\frac{\lambda_0 V}{n(C+V)}=\frac{\lambda_0}{n}-\Delta\lambda_2$ by $\Delta\lambda_1$ less than wavelength $\frac{\lambda_0}{n}$ in immovable water. During each period T_2 equivalent photons ν_0 are ahead before photons ν_2 by $\Delta\lambda_2=\frac{\lambda_0 V}{n(C+V)}$. To the moment t_2 the advance $\Delta\lambda_2 N_2$ accumulates where $N_2=\frac{t_2}{T_2}=\frac{L(C+V)}{\left(\frac{C}{n}-V\right)\lambda_0}$ - the number of the oscillations in photons ν_2 during the time t_2

λ_2=395.488 712 492 219 567 766 342 67283147 e-9 m

$\Delta\lambda_2$=0. 000 000 009 312 291 71042914604897304 e-9 m

N_2=7 519 810. 298 489 807 408 2213201105526

$\Delta\lambda_2 N_2$=70. 026 667 106 626 355 925 699 662 541 12 e-9 m

While equivalent photons pass the distance in water, photons ν_0 from additional pipe pass in the air the distance $\Delta\lambda_2 N_2 n$ and the fringe shift $\delta_{\lambda 1}=\frac{\Delta\lambda_1 N_1 n}{\lambda_0}$ arises. Because of $\delta_{\lambda 2}$, resulting fringe shift decreases as if photons of the beam 2 travel relative to water with the speed more than $\frac{C}{n}$.

$\delta_{\lambda 2}$=0.177 063 625 954 017 21175129362629932

c) During each period T_1, wave front ν_2 instantly shifts relative to moving water at distance $\left(\frac{C}{n}-V\right)(T_0-T_2)$. During the time t_2 the shift $\Delta_{T2}=N_2\left(\frac{C}{n}-V\right)(T_0-T_2)$ accumulates and, because of this shift, wave fronts ν_2 are behind in the air by $(n-1)\Delta_{T2}$ relative to the wave fronts traveling in pipe with immovable water. Additional fringe shift δ_{T2} arises:

$$\delta_{T2}=(n-1)\frac{\Delta_{T2}}{\lambda_0} \quad (6)$$

Δ_{T2}=0. 070 026 664 913 631 683 155 951937312474 e-6 м

δ_{T2}=0. 043 933 078 748 095 922 8846350149994

Thus, photons of the beam 2 are completely dragged by moving water and interference fringes shift by

$\delta_2=\delta_{V2}-\delta_{\lambda 2}+\delta_{T2}$ =0.2354946 - 0.1770636 + 0.0439330=0.102364

δ_2=0.102364

Resulting Fringe Shift δ

Resulting fringe shift δ is equal to sum of the fringe shifts δ_1 and δ_2 $\delta=\delta_1+\delta_2$ =0.10236408 + 0.102364=0.20472808 and is practically equal to the fringe shift which Fizeau received in his experiment in 1851.

Conclusion

The fringe shift in the interferometer with moving water is less than fringe shift in usual two-beam interferometers because of the change of the frequencies and additional phase deviations arising in interfering beams. Fresnel's explanation of the fringe shift decrease by hypothesis that the light is dragged partially by nonexistent aether is wrong and cannot be considered as confirmation of Einstein's special relativity.

References

1. Frankfurt UI (1968) Special and General Relativity. Nauka, Moscow 1968.
2. Fizeau AH (1860) On the Effect of the Motion of a Body upon the Velocity with which it is Traversed by Light. Philosophical Magazine and Journal of Science 19: 245-260.
3. Sokolov G, Sokolov V (2007) The Fizeau Experiment with Moving Water: A New Explanation. Galilean Electrodynamics.