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Abstract : We give in this document an altenative theory for the Fizeau's experiment (interferences carried out with a light beam crossing a tube filled with moving water). The numerical formula resulting from this alternative theory gives results identical to those resulting from the experiment itself, and thus, results are identical to the formulas using the relativistic addition of velocities. If this alternative theory had been proposed at the end of the 1800s, it is likely that the theory of the Special Relativity would not have known the success that it knew, since it made it possible to solve the contradiction between the experiment of Fizeau and Michelson's experience.

Historical review :
Fizeau's experiment consists of interfering 2 light rays which have each passed through 2 branches of a U-shaped glass tube filled with water, thus at C / N speed (with N = refractive index of water). The water is then moved at a speed W by progressively opening a tap, and the displacement of the interference fringes is observed. Initially Fizeau expected a displacement of the fringes corresponding to a classical and total addition of velocities (C / N + W in one branch and C / N – W in the other branch).

Experience has shown that the displacement of the fringes was lower than expected, and that the speed of the water was partially added up. An empirical formula has been given: the speed that adds or retreats at the speed C/N is given by: $W' = W * (1-1/N^2)$. Fresnel's explicative theory was that the light moves in the Aether, but that the water does not completely drag the Aether, only partially according to the coefficient $(1-1/N^2)$. To drag it more, it requires a liquid with a higher refractive index. In the air, whose refractive index is almost 1, then the entrainment of the Aether must be zero.

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

Since, with this theory, the air and the vacuum did not drag at all the Aether in which the light was supposed to move, then, it should be possible to detect the displacement of the Earth in the universal Aether supposed to be motionless .

Michelson and Morley imagined an interferometry experiment with two interferometric arms, one directed Northward, with a luminous path supposedly undisturbed by the luminous path in the aether, and the other directed Westward along the trajectory of the Earth on its orbit at 30 km/s, and therefore with a light

path affected by the aether wind suposed exist. The interferometer was then slowly rotated to neutralize the effect, and it was expected that the interference fringes would displace. We know that the result was zero: no displacement of interference fringes. The light path was unaffected by the wind of Aether. There was therefore no wind of ether.

https://en.wikipedia.org/wiki/Michelson-Morley_experiment

Science was in crisis. There was indeed a total contradiction between the Fizeau' experiment and the Micheson's experiment, according to the theory in force at the time.

It was easy, however, to give up Fresnel's theory (the partial training of the aether) and to take note of the Galilean behavior of light in the Michelson Morley interferometer (that is to say, the whole interferometer + light rays are all affected by the translation at speed 30 km/s) as well as a mechanical experiment made with masses on a horizontal support , placed in a airplane at constant speed.

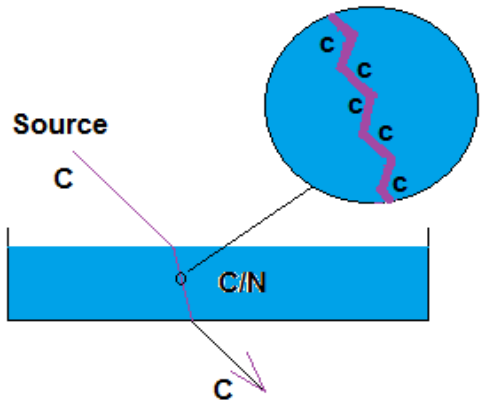
It was therefore necessary to find another explanation for Fizeau's experiment.

Instead, we waited until 1905 for Einstein to propose his new mechanics, his new addition of velocities, which explains both Fizeau's experiment and the Michelson-Morley experiment. Previously, French Poincarré had advanced formulas identical to Einstein, but he was convinced that - although they work well - they do not correspond to the physical reality of this world.

My explicative theory of Fizeau's experiment:

So I was interested in understanding Fizeau's experiment, and therefore in understanding the behavior of light when it enters the water and it comes out the water, and what happens when the water is moving relative to the source from light.

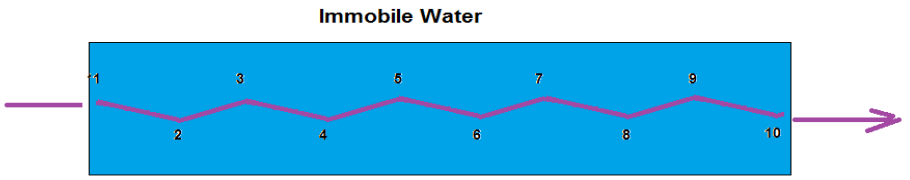
First, I suppose that, compared to the source, the speed of light on its trajectory is constant (equal to C) and that if it seems to go slower in the water, the reason is that its path is lengthened by the fact of a trajectory with angles produced by obstructions encountered in still water.

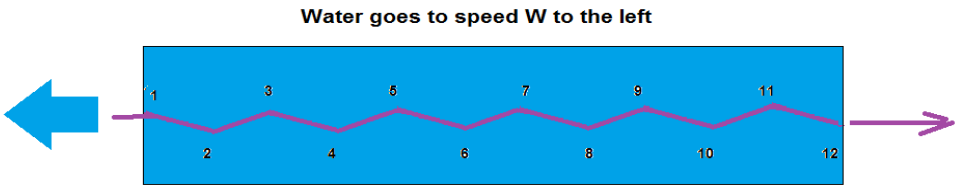


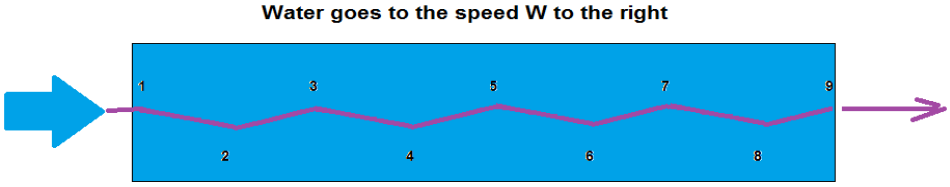
Then, concerning moving water, there are 2 cases to consider:

a) the case where the moving water is in the opposite direction to the direction of propagation of light. The obstacles encountered by the light over a distance D will be closer and more numerous than in still water.

b) the case where the moving water has the same direction as the propagation of light The obstacles encountered by the light over a distance D will be less close and less numerous than in still water.
The apparent velocity in still water C/ N is necessarily a special case of a formula giving the speed C/N ' in the water moving at a speed W with respect to the light source.







It is therefore advisable to give the formula of the refractive index as a function of the speed W of the water, and to check whether this formula restores N when W = 0

Moreover, this formula must be obtained by a logical and exact sequence of calculations starting from the initial hypothesis (obstacles more or less close together and numerous according to the speed W).

Finally, it is appropriate that the numerical result of the formula leads to velocities of light in moving water equal to those observed in Fizeau's experiment (notion of partial training), and which are given all as well by the formulas resulting from the 2 theories which gave good results:

a) Fresnel theory with its partial drag according to a coefficient in $(1-1/N^2)$ applied to the speed W

b) the theory of Einstein's Special Relativity with the relativistic addition of velocities (that of light in water C/N and that of water W)

This formula is the folowing :

$$N' = \sqrt{1 + (N^2 - 1) * \left[(C-WN)/C\right]^2}$$

In appendix, I provide:

1) the details of the calculations that led to this formula,

2) the results obtained with the 3 formulas from the 3 theories:

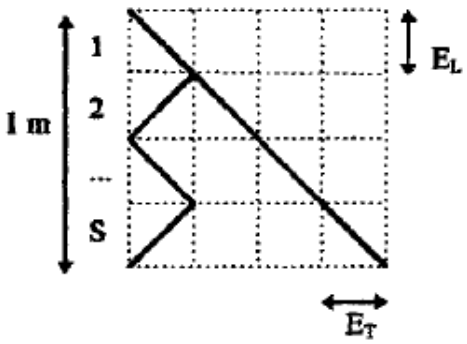
   a) Fresnel theory with its partial drag according to a coefficient in $(1-1/N^2)$ applied to the speed W

   b) Einstein's Special Relativity with the relativistic addition of velocities (that of light in water C/N and that of water W)

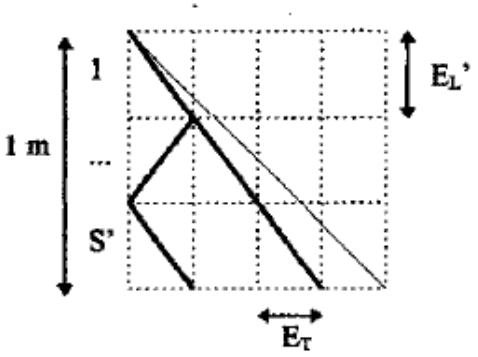
   c) new theory proposed by this document and that I called "Slalom Effect", in 1997

Appendix

1) detail of calculation :

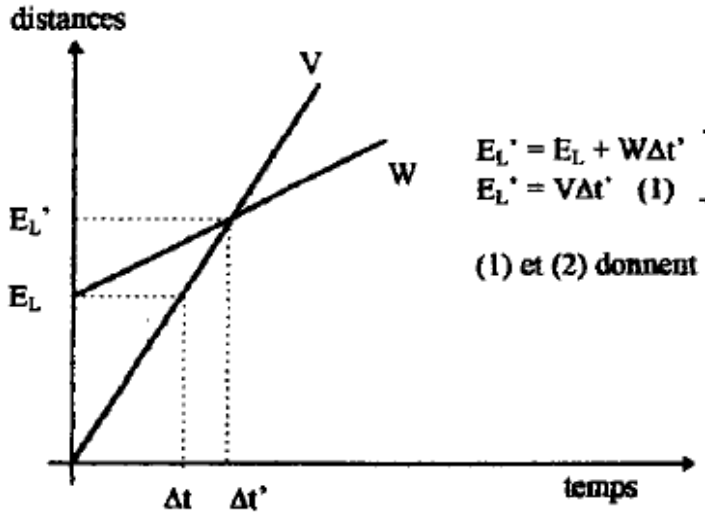


S est le nombre de sommets (EAU AU REPOS).
E_T est l'espacement transversal
E_L est l'espacement longitudinal
Sur 1 mètre de matière transparente au repos :
$S = 1/E_L$
Selon théorème de Pythagore ,le trajet des photons est :
$\sqrt{1^2+(SE_T)^2}$ et vaut 1,33 mètre dans 1 m d'eau au repos
donc $N = \sqrt{1+(SE_T)^2}$



S' est le nombre de sommets (EAU EN MOUVEMENT).
E_T est l'espacement transversal **(inchangé)**
E_L' est l'espacement longitudinal
Sur 1 mètre de matière transparente en mvt :
$S' = 1/E_L'$
Selon théorème de Pythagore ,le trajet des photons est :
$\sqrt{1^2+(S'E_T)^2}$ < 1,33 mètre dans 1 m d'eau en mouvement favorable
donc $N' = \sqrt{1+(S'E_T)^2}$

D'autre part, l'évolution de E_L est donnée graphiquement ci-dessous :



$E_L' = E_L + W\Delta t'$ ⎫
$E_L' = V\Delta t'$ (1) ⎭ $\Rightarrow \Delta t' = E_L / (V-W)$ (2)

(1) et (2) donnent $E_L' = V * E_L / (V-W)$

S étant inversement proportionnel à E_L, nous obtenons :

$S' = S(V-W)/V$

Comme $V = C/N$, cela donne :

$S' = S(C/N-W)/(C/N)$

$S'/S = (C/N-W)/(C/N)$

En multipliant par N au numérateur et au dénominateur, on a :

$S'/S = (C-WN)/C$ (2)

En utilisant les équations (1) et (2):

$$(N'^2-1) / (N^2-1) = \{(C-WN)/C\}^2$$

donc :

$$N'^2 = 1 + (N^2-1) * \{(C-WN)/C\}^2$$

donc :

$$N' = \sqrt{1 + (N^2-1) * \{(C-WN)/C\}^2}$$

2) Comparative results between the 3 theories , wich are very close , even for high speed of the water, example 100 m/s

Valeur W m/s	$V'=V/N$	$V'=V/N(1-1/N^2)$	Relativité	Effet Slalom
-1000000,000	224407511,524	224972841,522	224971741,657	224973129,247
-100000,000	225307511,524	225364044,524	225364032,924	225364046,761
-50000,000	225357511,524	225385778,024	225385774,950	225385778,409
-10000,000	225397511,524	225403164,824	225403164,645	225403164,784
-1000,000	225406511,524	225407076,854	225407076,846	225407076,847
-100,000	225407411,524	225407468,057	225407468,056	225407468,056
-10,000	225407501,524	225407507,177	225407507,177	225407507,177
0,000	225407511,524	225407511,524	225407511,524	225407511,524
10,000	225407521,524	225407515,870	225407515,870	225407515,870
100,000	225407611,524	225407554,991	225407554,991	225407554,991
1000,000	225408511,524	225407946,194	225407946,200	225407946,201
10000,000	225417511,524	225411858,224	225411858,184	225411858,323
50000,000	225457511,524	225429245,024	225429242,646	225429246,104
100000,000	225507511,524	225450978,524	225450968,320	225450982,149
1000000,000	226407511,524	225842181,525	225841101,034	225842480,081