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Fresnel Dragging Explained

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Declan@netspace.net.au

The Fresnel Dragging Coefficient required to explain the result of the Fizeau experiment can be easily explained by using the principles of Energy Field Theory set out in my earlier papers (see references at the end of this paper).

The key to understanding why the effect occurs lies in the understanding that as the light propagates through moving water it is being continually absorbed and re-emitted by each water molecule. Whilst absorbed by the water molecules, the light is slowed by refractive index factor n and carried by the water molecules at their full velocity; but when travelling between water molecules it travels at the normal, full speed of light (through the background energy field that is considered to be stationary with respect to the water).

The assumption that the light wave is slowed evenly and travels at a constant c_n through stationary water is wrong. The reality is that the transmission is a stop/start type of process, with the light slowing as it interacts with each water molecule, but travelling at full light speed between molecules. As a result of this, the c_n terms used in the equations that describe the travel times in the Fizeau experiment need to be modified to account for this difference.

Each particle of water is itself a standing wave comprised of energy waves that are moving through the background energy field, which acts as a medium. The background energy field is comprised from the sum of all of the particles (both near and far) in the causally connected Universe.

When a light wave is absorbed by a water molecule it causes the standing waves of the molecule to oscillate as they travel through the background energy field. Then, as the oscillation wave passes through the molecule and emerges on the other side, the oscillations cause re-emission of light into the background field, whereupon the light will then travel unimpeded to the next water molecule and so on.

Armed with this understanding, we can now analyse the experiment successfully:

When the water is flowing down the tubes in the experiment, the wave of disturbance due to the light wave propagating in the water is carried along with the water at the water's full velocity, as one would expect in a classical sense, causing the rate of passage of light to be increased or decreased, depending if the light is travelling in the same direction as the water flow, or against it. However, as the water molecules do not take up the whole volume of space, there exists space between them where the light travels at the normal speed of light with respect to the stationary reference frame. The distance that the light travels before it encounters another water molecule is a function of the speed at which light travels through space (the background energy field) and the speed at which the water is travelling. Thus, due to the water's motion whilst the light is travelling through the space between molecules, the distance the light must travel through space until it encounters another water molecule will either increase or decrease.

By taking into account these two effects that are occurring simultaneously and in opposite directions, the total delay on the travel of the light beam can be calculated.

The differing distance that the light travels between water molecules depending if it is travelling with or against the flow of the water can be treated mathematically as a differential in the speed of light in the up/down stream directions. Thus, effectively, the light travels in the upstream direction at a speed that is higher than c (the normal speed of light through the background energy field), and at a speed that is slower than c in the downstream direction.

To prove that this approach works, see the following maths.

The two light path travel times in the Fizeau experiment are:

$$t_1 = \frac{2L}{c/n - v} \qquad (1) \qquad\qquad t_2 = \frac{2L}{c/n + v} \qquad (2)$$

In the new analysis, we need to use the following new definitions:

$$c_{up} = c + v/n \qquad (3) \qquad\qquad c_{down} = c - v/n \qquad (4)$$

The reason for these definitions is that if the light travels unimpeded at speed c when between water molecules, rather than at c_n through the whole distance, then the distance travelled by the next water molecule that is about to receive the propagating signal will be different by the amount $\frac{v}{n}$ per unit of time.

If the propagating force between the water molecules were travelling at c_n, then in one unit of time, the next water molecule to receive the signal would have travelled a distance of v to meet the incoming signal. However, the propagating force is travelling between the water molecules at a speed of c (through the background energy field of space, as explained earlier) so the distance travelled in one unit of time by the next water molecule will be $v - \frac{v}{n}$. So the amount we must vary the c term in equations (1) and (2) is $\frac{v}{n}$. Thus we have equations (3) and (4) as shown above.

If we consider the Upstream direction as a case in point:

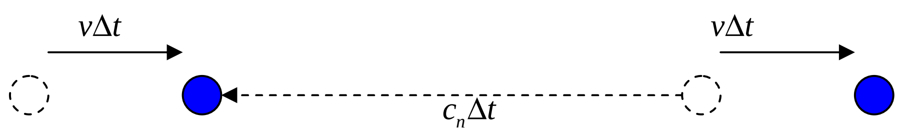

Fig 1: If the force between the molecules moved at c_n, then $v\Delta t$ would be the distance the water had moved during it's travel between molecules before it meets the light wave coming from the opposite direction.

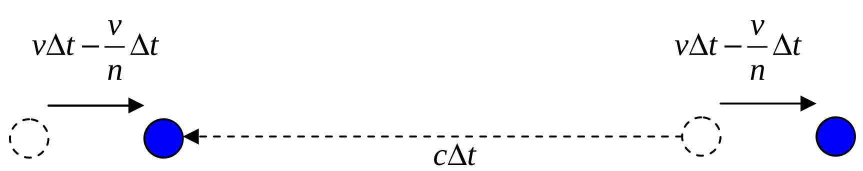

Fig 2: But the force between the molecules moves at c, so the water has moved $\frac{v}{n}\Delta t$ less during it's travel between molecules before meeting with the light wave.

Explanation for the change to c_n in equations (1) & (2):

Ignore for the moment the setbacks to the light's path by the water molecules that carry it backwards, and understand that for the light wave to travel through the space in the apparatus it must cover the full length of it to reach the end, then realize that during the passage through this empty space it is travelling at full light speed c, not at c_n. This being the case it becomes obvious that it will cover this distance n times more quickly.

So, as the water is moving at speed v through the apparatus, during the time that the light takes to travel through the empty space region (at speed c rather than at speed c_n), it will have travelled n times less distance: so $\frac{v}{n}$ less distance travelled by the water in the same time period.

So this means that during the light's passage through the apparatus there is a distance of $\frac{v}{n}$ less in which it will encounter water molecules and be slowed by factor n as a result of the encounter.

Thus when applying the factor n to the distance per unit of time that the light takes to travel through the apparatus this distance per unit of time $\frac{v}{n}$ must be taken into account (added on or subtracted from c) to give the correct number.

Therefore we have calculated the distance per unit time that the disturbance wave has effectively travelled ($c+{}^{v}\!/_{n}$ upstream or $c-{}^{v}\!/_{n}$

downstream) and then substitute these new values into equations (1) and (2) where the speed of light c appears:

Note: The factor n still needs to be applied to the effective speed of light calculated above as the absorption/re-emission processes & water molecule spacing/density is what accounts for the n factor, and these effects still occur and impede the travel of the light wave through the water column as before.

So equations (1) and (2) become:

$$t_1 = \frac{2L}{c_{up}/n - v} = \frac{2L}{\frac{c + v/n}{n} - v} = \frac{2L}{\frac{c}{n} - v\left(1 - \frac{1}{n^2}\right)} \qquad (5)$$

$$t_2 = \frac{2L}{c_{down}/n + v} = \frac{2L}{\frac{c - v/n}{n} + v} = \frac{2L}{\frac{c}{n} + v\left(1 - \frac{1}{n^2}\right)} \qquad (6)$$

Making the substitution:

$$v' = v\left(1 - \frac{1}{n^2}\right) \qquad (7)$$

Then equations (5) and (6), become:

$$t_1 = \frac{2L}{\frac{c}{n} - v'} \qquad (8)$$

$$t_2 = \frac{2L}{\frac{c}{n} + v'} \qquad (9)$$

Then to get the overall result, we combine the two times:

$$t_1 - t_2 = \frac{2L}{\frac{c}{n} - v'} - \frac{2L}{\frac{c}{n} + v'}$$

$$t_1 - t_2 = \frac{2L\left(\left(\frac{c}{n} + v'\right) - \left(\frac{c}{n} - v'\right)\right)}{\frac{c^2}{n^2} - v'^2}$$

$$t_1 - t_2 = \frac{4Lv'}{\frac{c^2}{n^2} - v'^2} \qquad (10)$$

This is the same as equation (5) in my paper titled "The Fizeau Experiment" (see reference at the end of this paper).

So the total fringe shift is:

$$\delta = \frac{c\Delta t}{\lambda_0} = \frac{4cLv'}{\lambda_0\left(\frac{c^2}{n^2} - v'^2\right)} \qquad (11)$$

Note: This result assumes monochromatic light is used in the experiment, as the effect of dispersion due to spreading of different component frequencies is not included here. A small correction needs to be made if not using monochromatic light.

References

"Relatively Simple? An Introduction to Energy Field Theory"
2001, Declan Traill
http://www.wbabin.net/traill/traill.pdf

Declan Traill "The Fizeau Experiment"
http://www.wbabin.net/traill/traill12.pdf