NEW VIEWPOINTS ON THE REFRACTION AND DISPERSION OF LIGHT

by: JUAN ALBERTO MORALES,
P. O. Box 6014,
Màlaga, Spain.

1. Introduction.

The accepted theory concerning the velocity of colored light is condensed in the following words of Max Born [1]:

As is well known, rays of light of different color (frequency) have different refractive indices, n, that is, different velocities. Hence it follows that the convection coefficient has different values for each color. But this ether would have to flow with a different velocity in the body, according to color. §

First of all, we have to say that the so-called Fresnel's partial convection does not exist, according to our demonstration [2]. In the second place, we shall show here how the rays of different colors move into a transparent medium with exactly the same velocity, in obedience to just one, unique refractive index.

We shall consider first the case of a ray in water moving in the same direction as a ray in air.

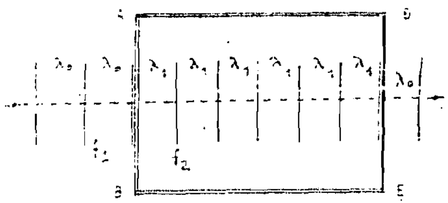

FIG 1

§. Editorial Comment: We cannot refrain from commenting on this statement made by Born. The velocity of light through an aether has little or nothing to do with the velocity of the aether itself (in this connection). We are concerned here with a phenomenon which is analogous to the velocity of a surface wave over water. The velocity of that wave is something apart from the rate of current flow. The aether might be quite at rest, yet the light waves move in it at whatever velocity is characteristic of them.

Generally, Born is a decent reasoner, but he seems to have been befuddled rather badly in this instance. That is what relativity does for the weak minds who believe in it.

The Toth-Maatian Review, 3101 20th Street, Lubbock, TX 79410, U.S.A.
Vol. 9, #2, July 1990, pp. 4447-49.

2. Ray in Water Propagated in the Same Direction as in Air.

Consider Fig. 1. ABDE is a transparent container filled with water. A source of light, of which we assume a typical wave of length λ_0 and frequency ν_0, sends a ray which impinges perpendicularly on the wall AB. Now, each time there arrives at the wall a wavelength λ_0, there also moves in the water a front which moves in the same direction but with a wavelength λ_1. If C is the velocity of light in air, and C_1 in water, by definition, the refractive index n is given by:

$$n = \frac{C}{C_1} \tag{1}$$

We also know that by definition, $C = \lambda_0 \nu_0$. Now, observe that if each time a front f_1 impinges on the wall AB, there is another front f_2 in the water which would mean that the same number of waves per second which enter into the container, will be in the water. In other words: the frequency in the water will be the same as in air. Only, of course, that in the water the wavelengths are shorter, namely λ_1. Hence we can write:

$$\lambda_0 \nu_0 = C \tag{2}$$

$$\lambda_1 \nu_0 = C_1 \tag{3}$$

from which

$$n = \frac{C}{C_1} = \frac{\lambda_0}{\lambda_1} \tag{4}$$

From this we deduce that the refractive index of a medium is given by the proportion of the wavelength in air to the wavelength in the medium, for each radiation.

Therefore, if in the ray in air there are some other radiations of wavelengths λ_2, λ_3, λ_4, ... , in the transmitting medium there would be the corresponding wavelengths λ_2', λ_3', λ_4', ... , so that

$$n = \frac{C}{C_1} = \frac{\lambda_2}{\lambda_2'} = \frac{\lambda_3}{\lambda_3'} = \frac{\lambda_4}{\lambda_4'} \tag{5}$$

3. Case of a Ray which Impinges in a Slanting Direction on the Surface of the Medium.

Consider Fig. 2. A front (12) of the ray SO moves from (2) to (4), one wavelength, namely λ_0, while the point (1) re-emits the front into the water, with wavelength λ_1. This wavelet, or elemental wave, is represented by the circumference of radius λ_1. Thus the new front into the water is indicated by the line (34). Since all the particles of the medium placed in the surface indicated by (34) are the centers of re-emission of the waves, according to our theory and the Huygens theory, the next front will be distant from (34) a wavelength λ_1. That is, the refracted ray along OR will move with velocity $C_1 = \lambda_1 \nu_0$. It has changed in direction but not in velocity. As was shown, the front (56) is the envelope of all the elemental waves generated in (34); and so forth.

Therefore, even if the refracted ray has the same velocity in water that it has when moving in the same direction as the ray in air, we conclude that, due to the phenomenon of the re-emission of the waves by the particles of the transmitting medium, the formula:

$$n = \frac{\text{Wavelength in air}}{\text{Wavelength in the water}} \qquad (6)$$

always applies.

Since the phenomenon observed in Fig. 2 would be repeated for all colors, with the only difference being that the angle ψ of refraction will be different, we can state the refractive index is a physical characteristic of the medium and has the same value for all colors.

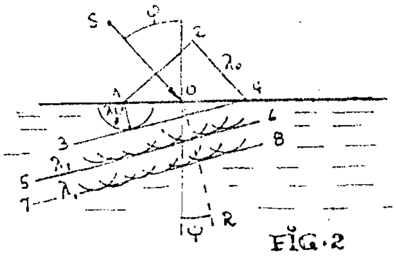

FIG.2

4. Proposed Proofs of the Proposition.

Consider Fig. 3. We make use of a source of light of determined color S. If the light is observed coming out from the bottom of the container at S_1, we should see that the frequency and the wavelength would correspond to those of the original source S.

With any other color whatsoever the phenomenon will be repeated. That is, all waves of all colors will recover after passing through the water, their original wavelength and frequency; and so then, their velocity in air. Since the frequency is the same in the water and in air, the wavelengths must preserve the proportions of equations (5, 4).

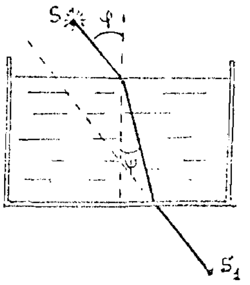

FIG3.

References

[1] Born, Max: **Einstein's Theory of Relativity**, p. 138-9, Dover edition, 1965.
[2] Morales, J. A.: **Demonstration that Fresnel's Convection of Light by Matter Does Not Exist**, Toth-Maatian Review, (this issue), V. 9, pp. 4423-30, 1990.