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Vibrational model on particles (compressed electromagnetic radiation)

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Abstract

The present work shows a model, where the particles are considered compressed electromagnetic waves, for which a zig-zag vibratory movement is proposed, in which the only speed that exists is that of light, however this zig-zag causes lower apparent velocities for the particles it generates, in addition to adding a vibrational velocity perpendicular to this apparent velocity.

Key words: waves, light, speed, zig-zag, mass

In a mechanical system, an object that impacts another object absorbs and dissipates energy as shown in the figure 1.

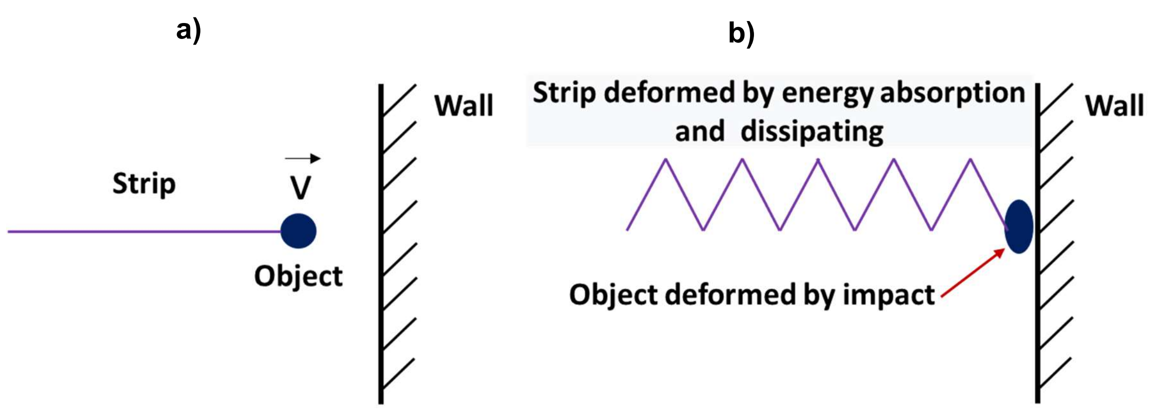

Fig. 1 a) an object before impact, b) an object after impact, the strip shows the phenomenon of energy absorption and dissipating.

The previous process exemplified could well be described as an abrupt braking of the object in this way we can think that a charged particle, when slowed down, would present a behavior similar to that previously described.

We can go further and propose that light and electromagnetic waves can be slowed down and start a zig-zag phenomenon, which would create particles as shown in the figure 2.

Fig. 2 Vibratory movement caused by the compression of electromagnetic waves.

In this approach we must understand that there is only one real speed, which is that of light c, the speed v is an apparent horizontal speed and the zig-zag represents a vibration or vertical speed. Equations 1 and 2 represents this movement.

$$mc^2 = mv^2 + hf \qquad (1)$$

$$c^2 = v^2 + \frac{hf}{m} \qquad (2)$$

However, the above formulas only describe what happens within the structure of an atom, where the total energy of a particle is **mc²**. The deduction of formula 1 is explained in a previous work titled: **"Atomic Model of the hydrogen based on pairs of forces analysis (balanced atomic model)"**.

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From formula 1 it is also possible to obtain equation 3.

$$hf = mc^2\left(1 - \frac{v^2}{c^2}\right) \qquad (3)$$

Which shows that if a particle inside an atom is completely stopped, that is, v = 0, it is completely converted into electromagnetic radiation. Equation 4.

$$hf = mc^2 \qquad (4)$$

Other expressions that can be derived, according to figure 3, are equations 5, 6 and 7.

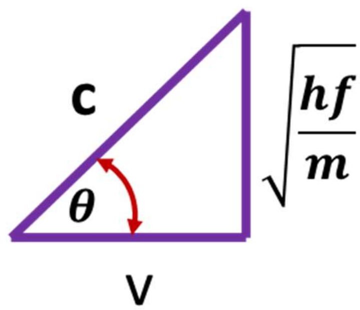

Fig. 3 Right triangle representing the vibratory motion of a particle.

$$\sin\theta = \sqrt{\frac{hf}{mc^2}} \tag{5}$$

$$\cos\theta = \frac{v}{c} \tag{6}$$

$$\tan\theta = \sqrt{\frac{hf}{mv^2}} \tag{7}$$

Equation 7 becomes particularly notable, because under this model, a rather interesting clearing can be made from it, which is shown in equation 8.

$$m = \frac{hf}{tan^2\theta v^2} \tag{8}$$

This last equation applies to an electron within the structure of an atom, but if this same equation were applied to any free particle outside the structure of an atom, this would mean that the value of the speed of light, could be imposed on the value of the speed in the equation and then, the mass that would be calculated would be the mass of a particle traveling at the speed of light. For this reason, it is a priority to analyze what would happen to a free particle under this vibrational model.

For a free particle, outside the structure of an atom, the following equation applies:

$$m_0c^2 + Nhf = \frac{m_0c^2}{\sqrt{1-\frac{v^2}{c^2}}} \tag{9}$$

The deduction of formula 9 is explained in a previous work titled: **"The transitive axiom in relativity"**

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Using an equivalent photon:

$$Nhf = hf_e \qquad (10)$$

$$m_0c^2 + hf_e = \frac{m_0c^2}{\sqrt{1-\frac{v^2}{c^2}}} \qquad (11)$$

$$m_0c^2\sqrt{1-\frac{v^2}{c^2}} + hf_e\sqrt{1-\frac{v^2}{c^2}} = m_0c^2 \qquad (12)$$

The right triangle is constructed in the following way. Figure 4.

$$c^2 = c^2\sqrt{1-\frac{v^2}{c^2}} + \frac{hf_e}{m}\sqrt{1-\frac{v^2}{c^2}} \qquad (13)$$

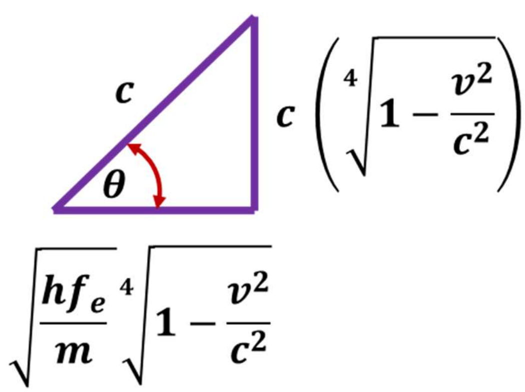

Fig. 4 Right triangle representing the vibratory motion of a free particle.

In this case:

$$v = \sqrt{\frac{hf_e}{m}}\left(\sqrt[4]{1-\frac{v^2}{c^2}}\right) = horizontal\ speed \qquad (14)$$

$$c\left(\sqrt[4]{1-\frac{v^2}{c^2}}\right) = vertical\ speed \qquad (15)$$

The horizontal speed seems to agree with de Broglie wave-particle duality, since:

$$\lambda = \frac{h}{m\gamma v} \qquad (16)$$

$$\lambda = \frac{h}{mv}\sqrt{1-\frac{v^2}{c^2}} \qquad (17)$$

$$\lambda f_e = \frac{hf_e}{mv}\sqrt{1-\frac{v^2}{c^2}} \qquad (18)$$

$$v = \frac{hf_e}{mv}\sqrt{1-\frac{v^2}{c^2}} \qquad (19)$$

$$v^2 = \frac{hf_e}{m}\sqrt{1-\frac{v^2}{c^2}} \qquad (20)$$

$$v = \sqrt{\frac{hf_e}{m}}\left(\sqrt[4]{1-\frac{v^2}{c^2}}\right)$$

In the previous analysis, the most important formula is equation 20, because it makes it possible to calculate the mass of any free particle, as a function of its speed and its equivalent frequency.

$$\boldsymbol{m = \frac{hf_e}{v^2}\sqrt{1 - \frac{v^2}{c^2}}} \qquad (21)$$

$$\boldsymbol{m = hf_e\sqrt{\frac{1}{v^4} - \frac{1}{v^2c^2}}} \qquad (22)$$

Therefore, if a particle travels at the speed of light, the result is:

$$\boldsymbol{m = hf_e\sqrt{\frac{1}{c^4} - \frac{1}{c^4} = 0}}$$

As can be seen, the relativistic effects take precedence, especially because they have been taken into account in the construction of the equations. However, if a speed is taken that tends to the speed of light, the equation will give a value.

$$\boldsymbol{m = hf_e\sqrt{\frac{1}{(v \to c)^4} - \frac{1}{(v \to c)^2c^2}}}$$

On the other hand, returning to the equation 8.

$$\boldsymbol{m = \frac{hf}{tan^2\theta v^2}}$$

This formula was made for an electron inside an atom, but if it were taken for any particle, the equation has no limits and could calculate the mass of a particle traveling at the speed of light and even faster. Implying that if there are particles that travel faster than light, they must come from the interior of an atom, through some physical phenomenon.

Analyzing the illustration of the right triangle, where the equation for calculating mass comes from, when $\boldsymbol{\theta \to 0}$. Figure 5.

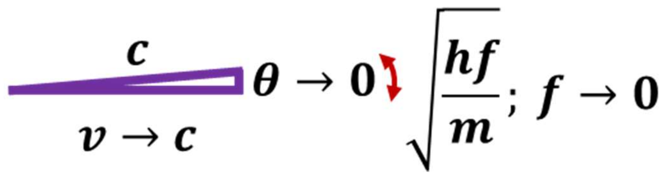

Fig. 5 Right triangle representing the vibratory motion, when θ → 0.

If $\theta \rightarrow 0$, $f \rightarrow 0$, thus $v \rightarrow c$. Therefore:

$$m = \frac{hf}{tan^2\theta v^2}$$

Where:

$$\frac{f \rightarrow 0}{tan^2\theta \rightarrow 0} \rightarrow 1$$

Then:

$$m_{lim\ \theta \rightarrow 0} = \frac{h}{c^2}\left(\frac{f \rightarrow 0}{tan^2\theta \rightarrow 0} \rightarrow 1\right)$$

And for any other right triangle with a limiting speed v_{limit}.

$$m_{lim\ \theta \rightarrow 0} = \frac{h}{v_{limit}^2}\left(\frac{f \rightarrow 0}{tan^2\theta \rightarrow 0} \rightarrow 1\right)$$