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Lorentz contraction of the Frequency of Electromagnetic Waves (EMWs) during Refraction

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"Je pense donc je suis" R. Descartes 1637

Abstract

The design of computers running not on moving electrons but on EMWs needs a serious review of our knowledge and theories about the behavior of EMWs upon refraction. The fact light can be slowed to 17 ms^{-1} is a serious challenge to Einstein special relativity, a theory based on the constant speed of light for all inertial frames. This study brings a new version of the Lorentz factor this time applied to only moving EMWs in condensed medium. For the first time quantum mechanics and special relativity are together in a new formulation of Planck energy law E=hν.

Keywords: Quantum Mechanics; Moving electrons

Einstein Special Relativity

According to the second postulate of Albert Einstein's special relativity, all observers in inertial frames will measure the same speed of light regardless of their state of motion [1, 2]. If the speed of an inertial frame is approaching the speed of light, special effects like time dilation and length contraction, will be measured with the Lorentz transformation boost. However, it is known before Einstein, after the work of Leon Foucault and others, that in dense mediums like water, glass and diamond, the speed of light is lower than in vacuum [3]. Einstein was not concerned with these results in the formulation of special relativity in 1905. In recent work by Hau LV and Kash MY and Brehm JD the speed of light is reduced respectively to 17 ms^{-1}, 90 ms^{-1} and 200 ms^{-1} [4-7]. The use of Bose Einstein Condensate (BEC) to slow down pulses [4,5,8] enhances tremendously the refractive index and reduces the speed of light [8] and can halt light pulse [5]. Whereas Einstein Special Relativity is based on the fact the speed of light is constant, we can no longer ignore these new developments based on slow light speed. In addition, the development of computers based not on moving electrons but on light pulses mandates new theoretical analysis. I am not going to propose a new version of Einstein special relativity. This theory is about moving inertial frames which never reach the speed of light. My goal is to study light behavior in vacuum compared to a medium with refractive index like glass or BEC.

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A New Version of the Lorentz Transformation Boost

The study by Chen uses the classical Lorentz transformation $(1- v^2/c^2)^{1/2}$ does not address the specifics of EMW, i.e. the frequency, the energy of EMW and the exit speed of EMW [9]. In previous studies I proposed that the frequency of an EMW during refraction diminishes and therefore its energy according to Planck law $E = h\nu$ diminishes too [10, 11]. I propose a new version of Lorentz transformation: $(1 + v^2/c^2)^{1/2}$, where, c is the speed of light in vacuum, v is the speed of light in a medium like glass or a BEC. ν_o is the frequency of EMW in vacuum, ν_r is the frequency of an EMW during refraction.

Therefore, $\nu_r = \nu_0/(1 + v^2/c^2)^{1/2}$

A New Version of Planck Energy Law E=hν

The Planck law during refraction becomes $E = h\nu_0/\left(1+ v^2/c^2\right)^{1/2}$. This new version of Planck energy law combines for *the first time* quantum mechanics and special relativity. In addition, this new version of Planck energy law shows that during refraction an EMW loses energy. A crucial issue is what happens to EMW frequency and energy upon exit form glass or Bose Einstein Condensate. I am submitting another paper to the same Journal of Physics and Astronomy in which I demonstrate the exit speed of an EMW from a refraction medium to air is the same as its speed in the refraction medium [12].

What happens to light upon exit from a BEC?

In both studies Hau *et al* and Lin *et al* using the same experimental set up, a BEC, the incoming probe carrying the information to be stored slowed down to 17 ms^{-1} [4, 5]. Upon exit from the BEC, all information we have is *regeneration* of the incoming probe. There is no indication about the specifics of an EMW: the exit speed, the exit frequency. According to this study the exit speed is 17 ms^{-1}. As for the exit frequency, let's specify the parameters. ν_{ex} is the exit frequency, ν_o becomes ν_{BEC} , ν becomes v_{ex} and c becomes v_{BEC} the speed in BEC is 17 ms^{-1}.

$\nu_{ex} = \nu_{BEC}/\left(1+v^2_{ex}/v^2_{BEC}\right)^{1/2}$. Since v_{ex} and v_{BEC} are the same, we have, $\nu_{ex} = \nu_{BEC}/(1+1)^{1/2}$. Therefore, the exit frequency is smaller than the frequency inside the BEC which is smaller than the frequency of the probe carrying the information for storage. This means there is no regeneration of the incoming probe after deposit of its information in the BEC. The same analysis can be made to other studies [6, 7].

Conclusion

I don't know if we can ever accept that an EMV can be halted in a material system and released after. I don't know if we can accept that an EMW refracts in a medium, a material medium of any kind, water or diamond or a BEC and exits that medium without losing some of its energy. The new formulation of Planck energy law puts quantum mechanics and special relativity together. Einstein did have many problems with quantum mechanics, especially its probabilistic interpretation. The reality of the variation of speed of light with the refraction index, and if the speed of light is 17 ms^{-1}, what happens to the equation $E=mc^2$? When c is equals to zero, because an EMW is halted, then E=Zero [5]. We have to remember that the original Planck law can be written $E=hc/\lambda$. In both energy laws, if c is equal to zero, that is not compatible with the concept that energy cannot be destroyed.

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