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QUANTUM TUNNELING AND TIME CONTRACTION, ACCORDING TO THE NEW RELATIVITY THEORY

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ABSTRACT
In this paper we shall introduce the concept of time contraction that is produced by the New Relativity theory of AlMosallami (NRM)[10]. When this concept is interpreted physically, quantum tunneling exceeds the speed of light in the vacuum as proven by experiment.

Quantum tunneling experiments have shown that 1) the tunneling process is non-local, 2) the signal velocity is faster than light, i.e. superluminal, 3) the tunneling signal is not observable, since photonic tunneling is described by virtual photons, and 4) according to the experimental results, the signal velocity is infinite inside the barriers, implying that tunneling instantaneously acts at a distance. We think these properties are not compatible with the claims of many textbooks on Special Relativity [1-9, 18].
The results produced by NRM are in agreement with results produced by quantum tunneling experiments as noted above, and thus it explains theoretically what occurs in quantum tunneling. It proves the events inside the tunneling barrier should occur at a faster rate than the usual situation in the laboratory. It provides a new concept of time contraction. Contraction in NRM means that, if an event occurs in a time-separation T in the laboratory (in a usual situation), then this event will occur in time-separation T' inside a tunneling barrier, where T'<T. The concept is proven by many experiments where some enzymes operate kinetically, much faster than predicted by the classical $\Delta G^{\ddagger}$.

In "through the barrier" models, a proton or an electron can tunnel through activation barriers [13, 14]. Quantum tunneling for protons has been observed in tryptamine oxidation by aromatic amine dehydrogenase [15]. Also British scientists have found that enzymes cheat time and space by quantum tunneling - a much faster way of traveling than the classical way - but whether or not perplexing quantum theories can be applied to the biological world is still hotly debated. Until now, no one knew just how the enzymes speed up the reactions, which in some cases are up to a staggering million times faster [16]. Seed Magazine published a fascinating article about a group of researchers who discovered a bit more about how enzymes use quantum tunneling to speed up chemical reactions [17]. The NRM theory answers all the preceding questions as we shall see in this paper.

(1) THE NEW RELATIVITY THEORY OF ALMOSALLAMI (NRM)

The New Relativity Theory of AlMosallami (NRM) adopts the definition of Heisenberg for the wave function, where he defined it as "a mixture of two things; the first is reality, and the second is our knowledge of this reality". Accordingly, the observer has the main role, as each observer creates his own knowledge of the phenomenon [12, 19, 20]. According to the NRM, we propose a train moving with constant speed v, and a static observer on the earth's surface. Now, if the earth observer registers that the train covered the distance Δx , at a given moment, the rider of the train will register that his train covered the distance $\Delta x'$, where

$$\Delta x' = \gamma^{-1}\Delta x \tag{1}$$

Where $\gamma^{-1} = \sqrt{1-\frac{v^2}{c^2}}$. For greater clarification, suppose the train started from rest to to cover the distance of 100 km where it moved with the constant speed 0.87c, (where c is the speed of light in vacuum). Now, when the train reaches the distance $\Delta x = 100km$ for the earth observer, we assume that he could stop the train at that point, and its speed is then zero. (In this example we shall neglect acceleration for simplification). Figure (1) illustrates the relationship between x (the distance that is passed by the moving train for the earth observer), and x' (the distance that is passed by the moving train for the rider of the train). Now, according to equation (1), when the earth observer registered that the train reached x=100 km, at this moment during the motion, the rider would register that his train has not passed 100 km, but it is still at x'=50 km at the middle of his trip. When the earth observer stops the train at x=100 km, the rider of the train would be puzzled as to how it reached the distance of 100 km, while he was at a distance of 50 km. Subsequently, the rider will confirm that the distance between $50 < \Delta x' \leq 100$ km was not covered by the train. His position is transformed from x'=50 km to x'=100 km at a time separation equal to zero.

Now if the rider of the moving train desired to observe the motion of the clock of the earth observer at the beginning of his trip, he would find the time separation of the train to cover the distance of 100 km is Δt for the earth observer according to his clock, where

$$\Delta t = \frac{\Delta x}{0.866c} \approx 4\times10^{-4}\,\text{second}$$

Figure (2) illustrates the relationship between t' (the reading of the moving train rider on the clock of the earth observer), and t (the reading of the earth observer on his clock). According to the NRM, the rider of the moving train will confirm that the motion of the earth clock is similar to his clock's motion (during the train motion). Thus, if the earth observer registered a time separation Δt by his clock, then at this moment the rider of the moving train should register a time separation $\Delta t'$ by the earth clock or by his clock, where

$$\Delta t' = \gamma^{-1}\Delta t \tag{2}$$

We get from figure (2), the seconds between $2 < t \leq 4\ (\times10^{-4})\,\text{sec.}$ would not be received by the rider, where the train of the rider stopped at $t > 4\times10^{-4}\,\text{sec}$ and he found that the observer was reading the seconds at $t > 4\times10^{-4}\,\text{sec.}$, while his last reading was equal to $2\times10^{-4}\,\text{sec.}$. That means the events experienced by the static observer between $2 < t \le 4\ (\times10^{-4})\,\text{sec.}$ were not received by the rider of the moving train. Subsequently we get that the rider of the moving train was living during his motion (in his present time) in the past of the earth observer. The events which are occurring in the frame of the earth observer are occurring at a faster rate than in the moving train frame. Now if the train rider desired to predict the speed of his train after it is stopped, he will compute the distance that it traveled as $\Delta x'$ which is equal to Δx, and the time separation of this event according to his clock, which is $\Delta t'$, thus he will determine this speed is equal to u' where

$$u' = \frac{\Delta x'}{\Delta t'} = \frac{\Delta x}{\gamma^{-1}\Delta t} = 2\times0.87c = 1.74c \tag{3}$$

Thus the rider will predict that his train was moving with a speed greater than the speed of light. But that speed is not a real speed as we have seen.

(2) THE EQUIVALENCE PRINCIPLE OF THE NRM

The $\gamma-factor$ which is equal to $\dfrac{1}{\sqrt{1-\dfrac{v^2}{c^2}}}$ in NRM is equivalent to the refractive index. The refractive index of a medium is a measure of how much the speed of light is reduced inside the medium. If a train was moving with constant speed v, then the speed of light inside this train is equal to $c' = \sqrt{c^2 - v^2}$ for the earth observer (as in the second hypothesis of the NRM). The refractive index of the moving train is equivalent to γ where $\gamma = \dfrac{c}{\sqrt{c^2 - v^2}} = \dfrac{1}{\sqrt{1-\dfrac{v^2}{c^2}}}$. From that we get the Helmholtz equation for phenomena periodic in time, with a frequency of $\nu = \omega / 2\pi$ inside the moving train as

$$\nabla^2\phi_x(x) + \frac{\gamma^2\omega^2}{c^2}\phi_x(x) = 0$$

Where γ is equivalent to the refractive index.

The equivalence principle of the NRM will allow us to understand quantum tunneling. For example, a typical soda-lime glass has a refractive index of 1.5, which means that in glass, light travels at 1 / 1.5 = 0.67 times the speed of light in a vacuum. This is equivalent to a train moving with a constant speed of 0.75c, where $\gamma^{-1} = 0.67$. Now if the speed of this train is equal to zero, then the speed of light inside it is equal to c for the static earth observer, where the events that occur inside this train will occur in a same rate as it occurs on the earth's surface. That is because according to the NRM, the internal speed of the medium inside the train is the same as on the earth's surface. But now if the internal speed of the medium of the train is less than the internal speed of the earth's surface, this is equivalent to the earth observer moving with speed v relative to the train. In this case it is equivalent to the γ' inside the train (the refractive index) to be purely imaginary. Then the solution of Helmholtz's equation is called an *evanescent mode*.

Similar features can be found for the stationary Schrodinger equation, where if a particle transformed from a frame of less internal energy (tunneling barrier) to a frame of higher internal energy (in the laboratory), it is equivalent to penetration of the particle through a higher potential energy U where E<U and E is the kinetic energy. Thus the solution inside the potential barrier is the quantum analogue of an evanescent mode. Obviously for electromagnetic evanescent modes, the refractive index plays the role of the potential in wave mechanical tunneling. NRM will give you a descriptive analytics transformation from the purely imaginary refractive index γ' inside the tunneling barrier to how it is related to the refractive index γ in the laboratory.

(3) QUANTUM TUNNELING ACCORDING TO NRM

The theoretical interpretation of quantum tunneling and the results produced by its experiments are given by the New Relativity Theory, (NRM)[10]. The NRM states that; in the case of a tunneling barrier, the internal speed inside the barrier should be less than the internal speed of the laboratory, thus the observer in the laboratory is equivalent to moving with speed v relative to the barrier and the observer inside the barrier is static. For more clarification, suppose a tunneling barrier of length ΔL where $\Delta L = 1 meter$. Now if a light beam is sent through this tunneling barrier and the observer of our laboratory measured the signal speed through this barrier, it would be 4.7c. That means in NRM, $\gamma = 4.7$ as from equation 3. This is equivalent to the observer in the laboratory moving with speed 0.98c relative to the tunneling barrier.

Now according to figure 3 and to the NRM, the events inside the barrier will occur at a faster rate than the same events outside the barrier (in the laboratory), that is, relative to the observer inside the barrier. Therefore, if we proposed that if both the observer inside the barrier, and the observer outside the barrier (in the laboratory) are agreed at the moment of transmitting the light beam inside the barrier at point A, then, according to the NRM, if the observer inside registered that the light beam covered the distance Δx through his barrier, then, at this moment, the observer in the laboratory will register that the light beam covered the distance $\Delta x'$ where;

$$\Delta x' = \gamma^{-1} \Delta x \qquad (4)$$

Subsequently, in this experiment there is formed a frame with contracted time inside the barrier relative to the frame of the laboratory, where the events inside the barrier will occur at a faster rate than the same3 events in the laboratory. Therefore, if the observer inside the barrier registered that the light beam reached the end of his barrier at point B, where it covered the distance $\Delta L = 1 meter$, then according to the observer in the laboratory, at that moment, the light beam had not reached point B, but was still at a distance $\Delta x'$ where;

$$\Delta x ' = \gamma^{-1} \Delta L = \frac{1}{4.7} \times 1 = 0.21 meter$$

where $\gamma^{-1} = \dfrac{1}{4.7}$.

After that, the observer inside will register that the time separation for the light beam to cover the distance of $1 meter$ in his barrier, is Δt according to his clock where;

$$\Delta t = \frac{\Delta L}{c} = \frac{1}{3.0\times10^{8}} = 3.3\times10^{-9}\ \sec ond$$

But relative to the observer in the laboratory the measured time separation of this event is $\Delta t'$ according to his clock, where;

$$\Delta t' = \gamma^{-1}\Delta t = \frac{1}{4.7}\times3.3\times10^{-9} = 7.0\times10^{-10}\ \sec ond$$

Subsequently, the light beam will exit the barrier, into the laboratory, and will be sensitive to laboratory detectors, where the observer will be puzzled as to how the light beam got out of the barrier from point B, while it was seen at point $\Delta x' = 0.21m$ inside. Thus, the laboratory observer will think that the distance between $0.21 < \Delta x' \leq 1m$ is not covered by the light beam relative to him, where the light beam is transformed from $\Delta x' = 0.21m$ to the distance $\Delta x' \geq 1m$ at a time separation equal to zero. Furthermore, since the light beam left the barrier without covering the distance $0.21 < \Delta x' \leq 1m$ for the laboratory observer, that leads us to refuse the relativistic causality of Einstein's relativity theory [1-9].

When we compute the speed at which light was moving inside the barrier, we would think that it was $4.7c$, where we divide the length of the barrier over the measured time separation according to our clock. Thus, we think that we are breaking the speed of light. But according to the NRM that is wrong. The speed of light for the observer inside the barrier is $\frac{\Delta x}{\Delta t} = c$, and for the laboratory observer, it was $\frac{\Delta x'}{\Delta t'} = c$ where $\Delta x' = \gamma^{-1}\Delta x$, and $\Delta t' = \gamma^{-1}\Delta t$. But since the events inside the barrier occurred at a faster rate than outside, then the light beam will exit the barrier before we see it pass the total length of the barrier, since at the moment that light exits the barrier at point B, we were seeing it at point $\Delta x' = 0.21m$, while for the observer inside, the light beam covered the total length of the barrier and exited. That means according to the NRM, when we look at the events inside the barrier -in our present-, we look at events in the past relative to the observer inside the barrier.

CONCLUSION

In this paper, we introduced a theoretical interpretation of quantum tunneling according to NRM. Our interpretation answers; 1) How the photon is transformed in a zero time-space through the tunneling barrier, 2) How we measure a light speed greater than the light speed in a vacuum. 3) How the enzymes speed up the reactions through the tunneling barrier, which is in agreement with the concept of time contraction in NRM.

To understand more about the concept of time contraction in NRM, suppose twins, John and Jack, are 20 years of age. Now if John stayed in the laboratory and Jack entered the previous barrier, and if Jack computed by his clock 4.7 years had passed and after that he exited the barrier to the laboratory, Jack would be 24.7 years, but the time that passed according to John is not 4.7 years, but $\Delta t' = \gamma^{-1}\Delta t = \frac{4.7}{4.7} = 1 year$, and his age is 21 years. Subsequently the tunneling barrier of Jack is speeding up time relative to their laboratory by a factor of 4.7. If a chemical reaction occurs in the laboratory in a time separation of 1 second, then if we put this reaction inside Jack's barrier, it would be performed in a time separation of 1/4.7 seconds.

We heard in the latest news about the Swine flu/N1H1 virus, where it performs a transforms each 40 years. If we would like to know what form this virus will take in 40 years, we should make a tunneling barrier of $\gamma = 1262304000$, then put it inside the barrier, we would get the form this virus would take after 40 years in 1 second according to our time. The time passed inside the barrier would be 40 years according to a clock inside, while the time passed according to our clock is 1 second.

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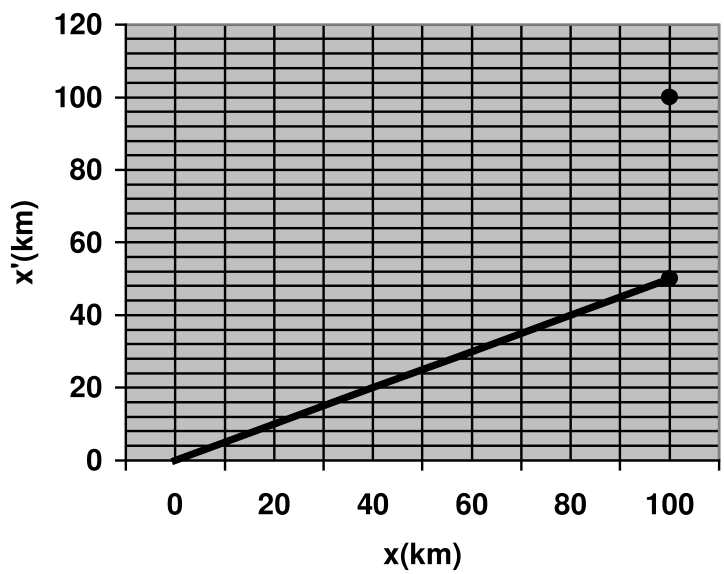

Figure (1): illustrates the relationship between x (the distance that is passed relative the earth observer) versus x' (the distance that is passed by the moving train relative to the rider).

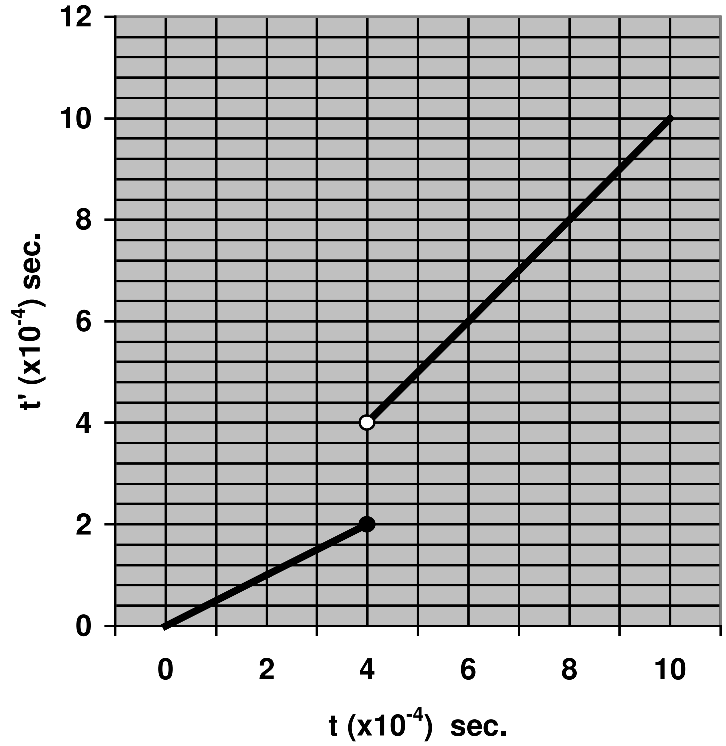

Figure (2): illustrates the relationship between t (the reading of the earth observer from his earth clock) versus t' (the reading of the moving train rider from the earth clock).

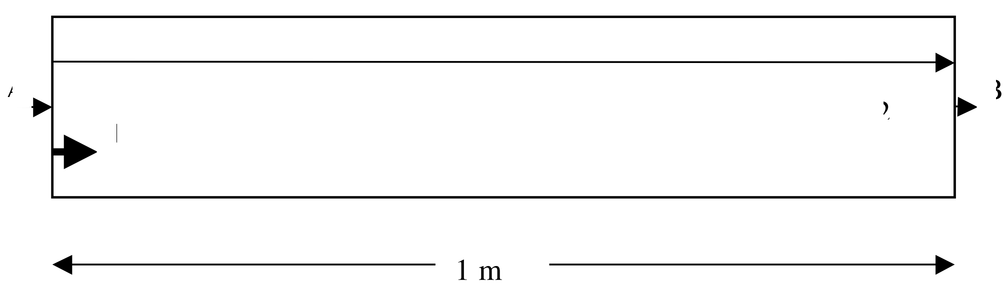

Figure (3): tunneling barrier; the observer inside the barrier will see the light beam is passing the length of the barrier 1m completely (ray 2). But for the observer outside the barrier (in our laboratory), at the moment that the observer inside registers that the light beam reached to the end of the barrier at point B, then we shall register that the light beam at distance $\Delta x' = 0.21m$ *(ray 1). After that the light beam will get out the barrier and will be registered at our detectors, where we shall be puzzled how the light beam transformed from* $\Delta x' = 0.21m$ *to* $\Delta x' = 1m$ *at a time separation equals to zero.*