The Quantum Entanglement May be a Small Wormhole

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Albert Einstein and Nathan Rosen are those who originally formulated the equations of a wormhole baptizing it a "bridge" [8]. *However, it was in 1957 that, for the first time, the name of "wormhole" was given to this phenomenon by physicist John Archibald Wheeler* [9].

Some equations of the relativity theory suggest that it would be possible to travel away, instantly, through a tunnel that was baptized "wormhole". Unfortunately, no one witnessed so far of such a tunnel that would own such a property. This mathematical property thus seemed to be only a chimera from the equations.

The quantum entanglement is a physical property that certain particles have together and which link them at distance in a way that seems instantaneous.

In this document, like physicist Sonner Julian and his team [5], we assume that quantum entanglement and the wormhole could be one and the same physical property. This hypothesis leads to the following conjecture: it is possible to entangle two similar particles (one made of matter and the other of antimatter), which were not initially entangled, through disintegration.

KEY WORDS: Quantum entanglement, wormhole, Eisenhower's door

1. INTRODUCTION

The quantum entanglement is a physics phenomenon that was making Einstein becoming crazy. He could not understand that two objects could be linked between themselves at distance without having a link between them.

In a pictorial approach, we want to show that it may be possible to create an entanglement link between two similar particles (made of matter and antimatter). We draw attention to the fact that we cannot verify by ourselves this hypothesis (by lack of monetary and physical means). However, according to the model that we made of a wormhole, it would be logical that this conjecture may one day be verifiable and be performed in the laboratory.

This paper therefore aims to draw the attention of the scientific community on the highly likely possibility that our hypothesis is true so that one day a laboratory may conduct this experiment.

2. THE QUANTUM ENTANGLEMENT

To help visualize the properties of quantum entanglement, let's say two coins that have one side "heads" and a side "tails". Suppose we hide these two coins in two different cups and gave one to a person A and the other to a person B. We ask to shake cups so that no one knows the condition of the coins. We then ask to he person A to go to Montreal and the other to Parish. If we ask them to lift the cup, we normally have one chance on two to have to have a different cup. If we repeat the experience a million times, the probability of chance that the two coins are different should be very close to 50%.

But then, if we put these two cups in a machine that makes the entanglement of the two coins and if we restart the experiment, the two coins would always fall differently. That is to say, if the coin of the person A falls "heads", that of the person B will necessarily fall "tails", and vice versa, and that, whatever the distance being between the two players.

It is as if there were an imaginary stick that would link the two coins. To have a better view, let's suppose that a stick is rolled on the ground. Let's call both ends "A" and "B". If the end "A" rotates in the clockwise direction, looking from the front, the other end "B" will rotate counter clockwise when we are looking at it from the front. If we change the direction of the rotation of "A", the rotation will change on "B". This seems obvious. But this is exactly what happens in entanglement, but without being able to see the stick.

3. BIRTH OF ENTANGLED PARTICLES

When an elementary particle arises from vacuum, it must born in pairs so that the assembly can maintain a zero momentum and a zero torque. Hence the particles of matter and antimatter. We must realize that the names of "matter" and "antimatter" are only names that we give to physical characteristics. Mathematically, for a particle of a given type, these features are transposed by different +/- signs. Of course, by convention (only), we agreed that the electrons were with "-" sign and were of matter. The electrons "e^-" find their equivalent in antimatter positrons "$e+$". For protons "$p+$", which are positive, we agreed that their equivalent in antimatter were "p^-". But the fact that electrons " e^-" and protons "$p+$" are considered "matter" is a convention that traditionally stems from our ignorance of what really matter and antimatter are.

Knowing that the same amount of antimatter arises whenever matter arises from vacuum, we can ask where antimatter goes. In fact, it is not so far. It is hidden in what we also call matter... For example, when " e^-" electron is created, a positron "e^+" is also created. By associations and reorganisation with other elementary particles (because, contrary to what is currently said, we do not believe that the electron or positron are elementary particles), positrons can hide in what we call protons "p^+".

Knowing that by a particle such as the electron "e^-" in the presence of its equivalent "e^+" in antimatter, we get a complete disintegration giving only photons, we have a hard time to understand that a particle of matter such as the electron may pass by an antimatter particle without disintegrating. Then, purely by convention, we agreed that electrons and protons were matter. By the way, nothing prevents another planet, in another galaxy, to have atoms made otherwise. In hydrogen, for example, we could have a positron "e^+" turning around a negative nucleus " p^-".

To return to our entangled particles, elementary particles are born in pairs made of matter and antimatter. These particles are still born entangled. The problem is that by releasing them into the wild, we quickly lose the account of which particle is associated with which other.

The chance that we take at random two particles of matter / antimatter and that are from the same source, so entangled, is almost zero. In fact, the chances are around $1/N$ where N is the maximum number of $2\pi R_u$ wavelength photons that we can find in the universe. The value of $R_u \approx 1.28\times10^{26}$ m is the apparent radius of curvature of the universe. The value of N is around 6.30×10^{121}.

According to previous work that we made [2], the precise value of N may be obtained as a function of the fine structure constant α.

$$N = \frac{1}{\alpha^{57}} \approx 6{,}303419512(12)\times10^{121} \quad \textbf{(1)}$$

According to other previous work that we made [3], the precise value of R_u may be obtained as a function of the classical radius of the electron r_e, of the fine structure constant α and of the constant β.

$$R_u = \frac{c}{H_0} = \frac{r_e}{\beta^{1/2}\cdot\alpha^{19}} \approx 1{,}283107880(81)\times10^{26} \quad \textbf{(2)}$$

According to the CODATA 2010 [1]:

- Speed of light in vacuum $c \approx 299792458$ m/s
- Classical radius of the electron $r_e \approx 2.8179403267(27) \times 10^{-15}$ m
- Fine structure constant $\alpha \approx 7.2973525698(24) \times 10^{-3}$

The value of β is an irrational number. It gives the ratio between the expansion speed of the material universe and the speed of light in vacuum c [4]:

$$\beta = 3 - \sqrt{5} \approx 0.76 \quad \textbf{(3)}$$

In previous works, we showed that the Hubble constant could be precisely determined with the help of the following equation [5,6]:

$$H_0 = \frac{c \cdot \alpha^{19} \cdot \beta^{1/2}}{r_e} \approx 72.0954863(46) \quad \textbf{(4)}$$

This value is partly verified by the Xiaofeng Wang team [7] that measured a value of $H_0 \approx 72.1(9)$ km/(s·MParsec).

We make here the hypothesis that the most elementary particle is the photon. The matter and the antimatter are made of confined photons. Moreover, for proof, when we take an electron "e^-" and that we put it in presence of a positron "e^+", they disintegrate to give only photons. As we need many confined photons to build an electron, the probability for an electron to meet its positron with which it is intricate must necessarily be superior to $1/N$. Effectively, by making an electron/positron pair, the number of remaining photons slightly diminishes.

If, inversely, we keep trace of the two new born particles, we will know that they are intricate. They will be linked like by an imaginary stick.

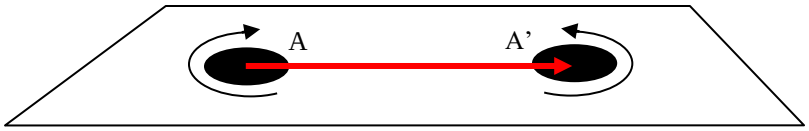

Figure 1) Illustration of a wormhole leading from the point A to the point A' passing on the top of the sheet of paper.

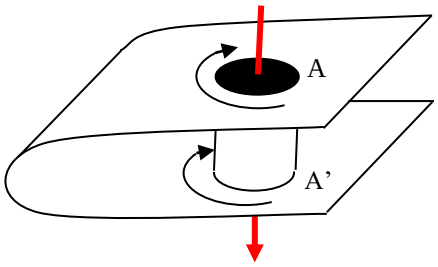

Figure 2) Illustration of a wormhole passing directly from the point A to the point A' without passing on the sheet of paper.

Now if we take two points (A and A' symbolizing a particle and its antiparticle) on a sheet of paper (see Figure 1) and we ask what is the maximum speed at which we can transmit information from one point to the other, everyone will agree to say that this speed is the speed of light in vacuum *c*. But there may be another solution. In fact, by folding the sheet in two on a way to align the two points by superposition, it would be possible to go from point A to point A' through the sheet (see Figure 2). And there, it would give the impression that the information transfers at an infinite speed.

The phenomenon of entanglement is much like a folded sheet of paper that we pierce. If, on entering the forefront of our pencil in the sheet, we make a clockwise motion (as in Figure 2) when it will come out of the sheet, it will make a counter clockwise movement (by unfolding the sheet, the direction of rotation appear as in Figure 1). It's like our stick that we presented earlier. The direction of the rotation of the stick depends of which end we are looking at.

Strictly spoken, the required pencil length to move from point A to point A' is zero when the sheet is folded (in Figure 2, we exaggerated the distance between the ends of the sheet to illustrate the point of the passage from A to point A'). But to see the connection A-A' when unfold the sheet and we put it flat on the table, we can see it as a string connecting the points A-A' which symbolize a zero length path (see figure 3). If there are other entangled points B and B' on the sheet, these points will create other strings. If every atom of the sheet is entangled with another, the result is a lovely hodgepodge of interwoven strings, but all representing zero length paths.

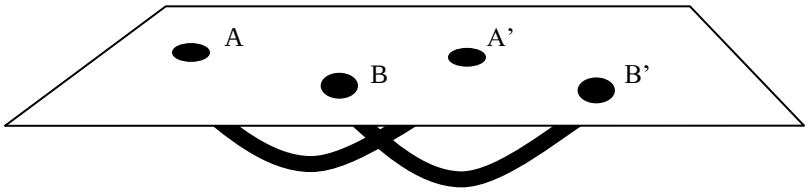

Figure 3) Zero length strings illustrating links.

4. TRANSFER OF THE ENTANGLEMENT PROPERTY TO OTHER ENTANGLED PARTICLES

As previously mentioned, all the elementary particles are born entangled. Photons, for example, are born with their entangled vis-à-vis the anti-photons. An atom, which is not an elementary particle, will hardly be entangled with its vis-à-vis made of antimatter, unless we construct it piece by piece by following track of each particles and avoiding the introduction of intruder particles that are not entangled.

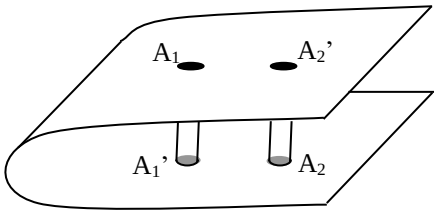

Figure 4) Illustration of 2 wormholes passing directly from the point A_1 to the point A_1' and from the point A_2' to the point A_2.

Let's suppose an A_1 entangled particle with a particle A_1' (see figure 4). In addition, also assume a particle A_2 entangled with a particle A_2' (see Figure 4). Let's suppose also that the particle A_1 is of the same type as the particle A_2. Of course it goes without saying that the particle A_1' is of the same type as the particle A_2'.

Let's suppose now that the particles A_1 and A_2' are becoming physically closer on the sheet of paper. This is equivalent to a particle and an antiparticle that are superimposing. We then have the situation shown in Figure 5).

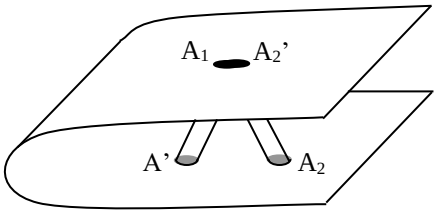

Figure 5) Web ring closer and superpose the A_1 and A_2' particles.

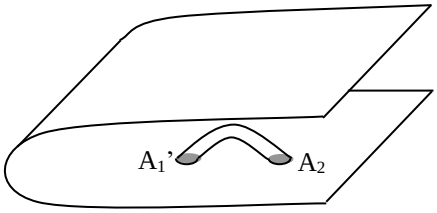

Figure 6) The A_1 and A_2' particles disintegrate in photons and leave the A_1' and A_2 particles entangled. We therefore intricate two particles that were not initially entangled.

By grouping together and overlapping, the A_1 and A_2' particles disintegrate by creating photons (see Figure 6). Although the two particles A_1' and A_2 were not initially entangled, a new entanglement link (a string of zero length) has just been created. From that moment, all what the particle A_1' will undergo will instantly be felt on the particle A_2.

5. CONCLUSION

In our model, we assume that a wormhole is actually a tiny quantum entanglement link.

We hope, by this document, arouse the curiosity of the scientific community about the possibility that the special link that is the quantum entanglement may sometimes be transmitted, via a disintegration of particles, to other particles that were not initially linked by such a link.

6. REFERENCES

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