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RAUCH INTERFEROMETER EXPERIMENTS ON NEUTRON ONE BY ONE –EXPLANATION PROPOSITION IN EVTD^2 THEORY

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Abstract:

This paper continues the others [1 and 2] whose principal consequences are adapted in the tentative to understand the interfaces of a particle (neutron) for the Rauch experiments in an adapted Mach-Zehnder interferometer. The original experiments [3] are correlated with EVTD^2 entities theory. The associated waves (which can further become pilots) are generated by moving corpuscles in the substratum (quantic ether) of above mentioned theory. They allow advocating the pre oriented output direction to the last separator. The associated waves are not "vide" but energetic, of electromagnetic type. Many conjunctures are established, mostly at the levels of the two separators and in the manner to modify one path, as for a neutron in transit.

Key words:

Rauch experiments, Mach-Zehnder, pilot wave, associated wave, quantic ether, substratum, EVTD^2 entities theory.

1. INTRODUCTION

This paper is a logical continuation to the previous studies [1 and 2] published also in the same volume of the Journal. It precedes, also in this Journal, plausible explanations to the problems on non-located entangled particles in Franson interferometer [4]. Of the same, here also is a space-time defined EVTD^2 [5-10] in theory of entities that is took into account as a framework in which, ultimately, would take place these experiments with neutrons. This space-time is entirely quantic in time and space and the EVTD^2 cubes, which it is formed, are subject to very high frequency vibrations (Planck's frequency), wherefrom the very energetic solicitation of this substrate.

All these studies have as starting point the [3] one, on the strange interference fringes of Young resulted from the particles (microscopic liquid drops) sent to piecemeal in an adapted device. The neutrons and even more the buck balls (C_{60} molecules) have consequent sizes in comparison with electrons and photons and yet they are subject, also, to interference to a particle.

The principal conclusion already underlined in the previous papers indicates ***the generation of waves associated with the particle during its movement***. *The waves are not noticeable with current possibilities because in the substrate names substratum, they are electromagnetic with short wavelength.* Thus, they can cross and reflect in a great number of material mediums. Initially they cannot be considered as pilot waves, being firstly generated by shock-impulses of the corpuscle on EVTD^2 entities.

It is only during the particle displacement that, according to the circumstances, they can guide the more consistent path of the particle. Indeed, if a device splits these associated waves following the multiple paths, it is clearly that they will carry some information of those paths up to their possible meeting.

There is, therefore, constructive or destructive overlays of these waves which will modulate the energy states of the paths suites followed, in common, by these "twin" waves. It is not, strictly speaking, a choice of output which is offered to the particle regardless of its arrival path on the last separator.

Therefore, the indistinguishable paths is not inherently major (this is false problem here) because, regardless, for one as for the other paths effectively borrowed: the more energy output will be one that will attract the particle. It could be the same image as for a cork floating in a torrent. While the torrent offer two derivation of its course around a rock, it is obvious that the cork will be trained in the derivation with the strongest current. It is possible to affirm that the particle did not test every path but, the twin associated waves would do the work of paths recognition. Arrived in meeting point of the last separator, they, therefore, combine their states of phase "information" for the different possible outputs.

2. REMAINDERS ON RAUCH EXPERIMENTS WITH A SINGLE NEUTRON

The studied particle is not the photon as in [1] and [2], but a neutron sent to piecemeal in a Mach-Zehnder, a little special, organized in a mono crystal.

The schema in the figure 1 represents this device adapted to these special features of this corpuscle. The regular organization of mono crystal atoms gives the possibility to have three separators, thus allowing transmissions and reflections. Some of these resulting trajectories are redundant, especially the third and the fourth. The study paths are the first and the second. In fact, the second separator plays, here, only the double role of symmetrical mirrors M_1 and M_2.

This adapted Mach-Zehnder can be balanced or unbalanced, the two case being represented in the same figure 1. In fact, the unbalanced interferometer is caused here by the use of another physical property which is the action of a magnetic field ***B,*** vey local. It will rotate the spin direction of neutron borrowing this second trajectory and the magnetic field action will results in the differentiation of paths for the neutron corpuscle.

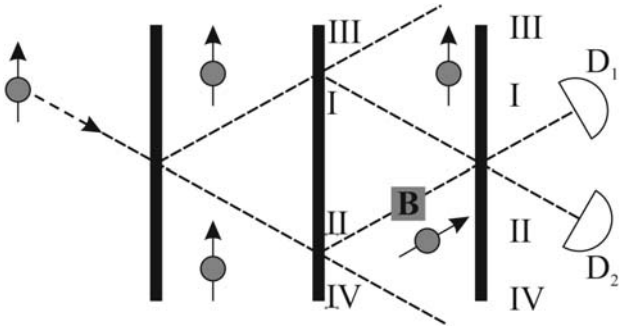

Fig. 1. Schematic representation of Rauch interferometers: the magnetic field B creates the unbalance by modifying the spin direction on the trajectory II.

To *quantify the difference of one path from one another one should be directed*, here more specifically, ***to the half value of the angle formed by the directions of each neutron spins*** on I and on II, according to assertion of V. Scarani in its book [11]. It will prove that this is of great importance for the future.

Remainders of different results well established obtained, following different conjunctures, for these experiments:

1 – The magnetic field ***B*** is not active on the trajectory II – all the neutrons go out in D_2 because the paths are indistinguishable (balanced Rauch).

2 – In the case when the value of ***B*** is those producing a spin rotation of 180°, the paths become distinguishable and the neutrons behave "normally" taking 50 % the output D_1 and D_2. Indeed, is only in this case, when the spin directions are in opposition, that the measures are reliable. The borrowed path is then known with certainty, by the measurement done at the output.

3 – If the spin direction rotation is of 360°, or 2π, all neutrons arrive in D_1.

4 – If the spin arrow makes two complete rotations, i.e. 4π, which means it, is the return to the initial situation with all neutrons arriving in D_2. This conjuncture is called *symmetry 4π of the spinner*.

3. STUDY OF THE EXPERIMENTS IN EVTD^2 THEORY, WITH THE CONCLUSIONS OF PREVIOUS WORKS

For the first case, when the field ***B*** is not active, it is to simply come back to the same considerations and conclusions as in the case of photon in balanced Mach-Zehnder interferometer. [2] the twin associated waves arrive in phase on the last separator and the output D_2 is the most energetic – it leads, so every time, each neutron.

For the second, third and fourth cases it will be highly interesting to be correlated with those mentioned in [2] for the different elongation values in unbalanced Mach-Zehnder interferometer. The first trajectory remains identically for all tests and, thus, is on the second trajectory that the solutions to questions will be found, once again. Indeed, for these and inside the associated waves, already described, it will be convenient that *the phase changes on the twin wave be induced on the browsing second unbalanced trajectory.*

These phase changes could allow to explain, in the best, the different scalable changes which are recognized on the outputs in D_1 and D_2. But, we only dispose as information that on this trajectory, the spin of neutron in transit has its arrow changing under the action of very localized magnetic field. Obviously, there are not specifically the spin direction changes that create the interference fluctuations as to favor a preferential output. *It remains, without ambiguity, that it's almost one-off action of magnetic field **B** that creates the interesting evolutions*. Could it be that the ***B*** field produce effects which are not observable, let's say, on the twin associated wave? This is to modify its phase states up to the impact on the last separator, which would be like the similar cases studied [2] on the unbalanced Mach-Zehnder interferometer.

It is necessary to remind, once again, the associated waves result from shock-impulses of the particle on the electromagnetic EVTD^2 of the space-time. Thus, the associated waves will be, also, of electromagnetic type. Indeed, since shock-impulses create fluctuations of electromagnetic type of this field, *it follows its distortion as electromagnetic waves. Thus, magnetic **B** will have a certain influence on these waves both and so this will surely result in fluctuations of phase of the compatible associated wave.*

Let us consider the case when all the neutrons arrive in D_1, which is the most convincing case study and this will be for a spin arrow deviation of 2π. Above, it was mentioned that ***the important and significant value is the half of deviation angle, therefore, here:*** π. For the same configuration case in Mach-Zehnder [2] we have detailed show that every *b* adopted value (the half of elongation) induced a supplementary phase difference of $\pi/2$. This produced a global phase difference of π for the total elongation ($2b$), which would be transmitted till to the output separator. *Therefore, there has been phase opposition of two arrivals on the separator and, thus, a preferential output reverse to the initial case, as has been demonstrated.*

The same influences and consequences are present for ***B*** and the neutron, wherefrom, identical results. For the other cases of modulate field ***B*** leading to other deviations of spin in these experiments, the same approach is followed by. It allows the correlation of results always with the equivalent cases of Mach-Zehnder with the photon. The 4π of the spinner return to a 2π phase difference (phase agreement) of the associated wave, which return to the initial case, the balanced interferometer with the field $\boldsymbol{B}$=0. For the deviation of π (phase opposition), the half of these angle is $\pi/2$, which means, also, the phase difference of twin waves and, the arrivals will be 50 % on the output D_1 and 50 % on D_2.

4. CONCLUSION

Here are found the same explanations [1-3] to understand the enigmatic results concerning these different devices and these well differentiated particles. The master plan of understanding lies in the conception of the

associated waves, electromagnetic and spreading in a quantic substrate organized in EVTD^2. These waves become pilot ones when several possible trajectories appear. At the end of these work, the prognosis of the existence of a universal quantic space-time seems to specify. The notion of indistinguishable paths loses his interest because it is the states of phase of twin associated waves that make the decision and the path taken by the particle has no importance. As to the non-location of particles this is studied in [4] in this review.

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Interpretare, în teoria EVTD^2 a experienţelor lui Rauch in interferometria neutronului unic

Rezumat: Această lucrare urmează publicaţiilor [1-2] ale căror principale consecinţe sunt adaptate în încercarea de înţelegere a interferenţei unei particule (neutron) pentru experimentele lui Rauch într-un interferometru Mach-Zehnder adaptat. Experienţele originale [3] sunt corelate cu teoria entităţilor EVTD^2. Undele asociate (ce pot deveni, în continuare, unde pilot) sunt generate de corpusculii în mişcare in substratum (eter cuantic), definit în teoria menţionata mai sus. Ele permit prevederea direcţiei pre-orientate de ieşire la ultimul separator. Undele asociate nu sunt „vide" ci energetice, de sorginte electromagnetică. Ca şi pentru neutronul in tranzit, sunt stabilite numeroase conjuncturi la nivelul celor doi separatori şi în modul de modificare a unei traiectorii.

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