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THE PHOTON THEORY: THE FIFTH DIMENSION AS A SOLUTION OF THE UNUSUAL EINSTEIN-PODOLSKY-ROSEN PARADOX

1. Introduction

In the photon world the description of much observable phenomena is restricted by the recognized theories, the quantum theory and the special theory of relativity. For example:

- the wave/particle duality
- paradoxes of the emission process
- the instantaneous reduction of the wave front in the moment of absorption or
- the instantaneous communication of information through two correlated photons (EPR Gedankenexperiment) [1, 2].

The existence of such contradictions and paradoxes shows, that the existent theories that describe the photon world do not suffice.

A. Einstein and his colleagues B. Podolsky and N. Rosen published in the year 1935 in the journal „Physical reviews" the article about a Gedankenexperiment about the instantaneous communication of information through two correlated photons [2]. This Gedankenexperiment is called „EPR paradoxon" and is not solved yet.

Einstein and colleagues constructed the EPR Gedankenexperiment, because they wanted to show, that the quantum theory is uncomplete or wrong, because in case that the instantaneous communication of information through two correlated photons happens, the velocity of light is not the highest velocity. Therefore they thought, that this effect is impossible.

Since the 1970s the development of science and technology allowed to proof the EPR Gedankenexperiment with optical correlated photons. The result of these experiments shows, that there is an instantaneous communication of information through two correlated photons. Einstein and his colleagues were wrong [3–8].

1997 experiments were done to send information instantaneous via correlated photons [9]. The experimentators described their experiment as „quantum teleportation". In the same year it was proofed in Switzerland, that the correlation between two linked photons is stable over a long distance [10].

The logical analysis of an optical EPR experiment, the studying of the effects of correlated photons produced by parametric fluorescence, showed that there is no usual solution for this paradox. During the process to eliminate the paradox of the effects of this correlated photons the Photon Theory was created.

This does not mean, that the Photon Theory is the ultimative solution, but with the photon theory it is possible to solve some mysterious effects of the photon world [11].

2. The analysis of the EPR paradox

2.1. Description of the process

With a two-photon cascade process (parametric fluorescence) quantum mechanical correlation persists between the two emitted photons, eg.: that the entire spin impulse from the system of both emitted photons must be zero. Both photons find themselves in a linked quantum mechanical position. If we consider correlated photons which are emitted, after the measurement of the polarization of one photon the polarization of the second photon is determined. If it was established that after measurement the first photon is linearly polarized in a certain direction, the second photon is also linearly polarized in the same direction.

One could have measured circular, instead of linear, polarization. After the conclusion of the experiment, one could arrive at the assertion, that the second photon is either respectively left or right circular polarized, on the basis of the linked quantum state of both photons.

That a photon is either linear or circular polarized will only be determined after the measurement of the first photon. The measurement dictates a linear or circular polarization for photon 1, this means, that only after the polarization measurement of photon 1 the polarization of photon 2 would be established!

This result appears paradoxical: that both photons „move away" from each other with speed of light means, that no information exchange can occur between the photons due to the impossibility of the transfer of information at a speed higher than speed of light.

The information exchange seems to occur, however, independent of the distance between the photons.

2.2. Analysis of the phenomena

The result of the described optical EPR-Gedankenexperiment will be analyzed from the viewpoint, that no paradox exists.

Viewed from the quantum theory, the total spin of the dual photon system is zero and so both photons, independent of the distance between them, are correlated. The polarization properties for the whole system would, however, be established after the measuring of the first photon

The actual problem from the viewpoint of quantum mechanics is not that the measurement at photon 1 instantaneously establishes the polarization of photon 2 and with it an information exchange over the distance between the two photons occurs immediately.

The central problem from the viewpoint of quantum mechanics is that with a local theory, which does not contain an element of space-time, the duality of both photons can be described. Non-local statements can not, in principle, be made from a local theory.

It is suggested, that if with local theories only local effects can be described, then we arrive at the astoning result, that the determination of the polarization direction of photon 2 after the measurement at photon 1 must be a local effect, whose occurrence can be described with a local quantum mechanical theory.

How does the problem appear from the viewpoint of the special theory of relativity?

The polarization of photon 1 is measured after the cascade emission of both photons at a point at a limited distance from the emission point. Instantaneously the polarization of the equally distant photon 2 is established as the same. For this fact to occur, must be a timeless information transfer, which is impossible in according with the theory of relativity.

This argument, however, contains serious mistakes.

For objects moving at the speed of light, is in according to the special theory of relativity time and space reduced to zero. In the case of our photon pair, in the reference system between both photons no space-time division occurs. Simply from the reference position of the stationary observer, it appears that both photons move from each other with the speed of light from the emission point. The decisive local/non-local is therefore a question of the reference system. That the both photons are correlated and that the effect, the establishment of the polarization characteristics of photon 2 after the measurement of photon 1, covering this system, means that the reference system can not be chosen: it is the reference system of both photons. The effect is therefore not a distant effect, but a close one!

Viewed from a stationary observer that is not part of the system of both photons, but part of the environment the behaviour of the two photons is not

understandable. Only in his brain he projects the way of the photon from the point of absorption back to the point of emission in space and time, within our four dimensional space time continuum. As for him it is clear, that the photons have moved in space and time within our four dimensional space time continuum and that they are constantly part of the four dimensional space time continuum. Because of this wrong description the behaviour of the correlated photons seems to be mysterious and paradoxal, because the information of the polarization state of photon 1 is instantaneously present at photon 2, independently of the seeming distance of the two photons.

The most interesting and for the description of the effect the only important question is: What is the viewpoint in the system of the two photons?

After emission the two correlated photons are directly linked. As for them they have no distance in space and time in their own system. They are not „real", they are „potential". In the moment of observing (absorption) they change their state from potential to real. It is enough, if one of these two photons is observed, because their physical state is linked. The photons for themselfs have no real velocity in space and time. In the state of potentiality it is not possible to obeserve the photon, it is postulated, that in the state of potentiality the photons are not part of the four dimensional space time continuum. The moving of the photons in space and time is no real effect, but a effect of our imagination. It is just a wrong projection in our mind from the point of the absorption back in space and time to the point of emission.

After measuring of polarization at photon 1 the polarisation of photon 2 is instantaneously determined. The linked quantum mechanical position of the two photons, that describes the state of potentiality, is destroyed. The two photon system has achieved our four dimensional space time continuum, our plain of reality.

3. The Photon Theory

The Photon Theory is formulated in according to the above-mentioned considerations.

1) Photons and other messenger particles with zero mass are existing from the point of emission to the point of interaction (absorption) out of the four dimensional space time continuum, in the Photon Continuum.

2) Emission point and absorption point are the only observable points of intersection between the Photon Continuum and the four dimensional space time continuum. Emission point and absorption point are directly connected out of time and space through the Photon Continuum.

3) The Photon Continuum is a new dimension, the dimension of interaction.

4) The light-speed c does not exist in the four-dimensional space time continuum: it is a projection from the Photon Continuum into the four dimensional space time continuum and therefore the greatest observable speed in the four-dimensional space time continuum.

4. Conclusions

The Photon Theory requires the existence of the Photon Continuum, which, as a fifth dimension act as a bridge for messenger particles of a zero stationary mass between the emission and interaction points. A general applicability of the Photon Theory to gravitons will be also postulated.

What kinds of assertions can be made about the Photon Continuum?

The Photon Continuum is a continuum of potentiality. It contains no space-time qualities and represents the connection, out of space and time, between the points of emission and interaction for photons. Within the Photon Continuum the photon exists in a state of potentiality.

Because of this connection of the photon with the emission and interaction points, the photon will always take the most opportune possibility of interaction. The so called „collapse of the wavefront" at the point of interaction occurs through the transfer of the entire emitted energy contained by the virtual probability wave, marking the shift from a situation of probability to reality.

The interaction occurs at the front of a spherical wave (so described from the viewpoint of our four dimensional space time continuum), and the whole potential of the spherical wave is concentrated at the point of interaction, the so-called "collapse of the wave front". This collapse of the wave front occurs in the Photon Continuum; projected into our four dimensional space-time continuum, it occurs spontaneously, that means, without space and time.

Both the emission point, the point of origin for the wave front, and the point of interaction are the intersections of the four-dimensional space-time continuum with the Photon Continuum. Emission and interaction points are directly connected with each other through the Photon Continuum. Because of it the paradox of the "collapse of the wave front" is solved by the Photon Theory.

From the position of a stationary observer, the projection of the linking of the points of emission and interaction through the Photon Continuum into

the four dimensional space-time continuum is perceived as a spherical wave, which is described as moving from the point of emission with the speed of light c and reaches the point of interaction in spatial distance r after a period of time $t = r/c$.

The emission point and the point of interaction within the whole emission-absorption process are components of the four-dimensional space time continuum and therefore both are observable and can be described using laws valid for the four dimensional space-time.The light-speed is not a real speed within the four-dimensional space time continuum, but rather merely a projection of the Photon Continuum into the four dimensional space-time continuum. This assessment is already present in the special theory of relativity in the form of the relative shortening of distance and time. Quantum theory does no need information of time and space to describe the process of parametric fluorescence and the „behaviour" of the linked photons or the absorption of photons.

The viewpoint of the Photon Theory can be a brige between quantum theory and special theory of relativity!

Through the use of the Photon Theory, a solution is found to the EPR Gedankenexperiment and other further described paradoxes of the behavior of zero-mass particles evaporate.

References

1. *Paul H.* Photonen. Eine Einführung in die Quantenoptik. Stuttgart. 1995.
2. *Einstein A., Podolsky B., Rosen N.* Can quantum mechanical description of physical reality be considered complete? // Phys Rev. 1935. Vol. 47. P. 777–780.
3. *Freedman S.J., Clauser J.F.* Experimental test of local hidden-variable theories // Phys. rev. lett. 1972. Vol. 28. P. 938–941.
4. *Paul H.* The Einstein Podolsky Rosen Paradox and hidden-variables theories // Fortschritte der Physik 1980. Vol. 28. P. 633–657.
5. *Aspect A., Grangier P., Roger G.* Experimental test of realistic local theories via Bell's theorem // Phys. Rev. Lett. 1981. Vol. 47. P. 460–463.
6. *Aspect A., Dalibard J., Roger G.* Experimental test of Bell's inequalities using time-varying analyzers // Phys. Rev. Lett. 1982. Vol. 49. P. 1804–1807.
7. *Davies P.* About time. Einstein's unfinished Revolution. New York 1995.
8. *Davies P., Gribbin J.* Auf dem Weg zur Weltformel Muenchen. 1993.
9. Experimental quantum teleportation / D Bouwmeester, J.-W. Pan, K. Mattle et al. // Nature 1997. Vol. 390. P. 575.
10. *Watson A.* Quantum spookness wins, Einstein looses in photon test // Science 1997 Vol. 277. P. 481–482
11. *Haas R., Kreysig D.* Die Photonentheorie // UWSF-Z. Umweltchem. Oekotox 1997. Vol. 9. P 181–182