Clarification on Bell-test experiments

Gerard van der Ham

Abstract:

In this paper the outcomes of Bell-test experiments are accounted for in a local-real way. In a visual way is explained why Quantum Mechanic correlation is found in experiments and why Bell's inequalities are violated.

If an experiment is described by a correct set of equations then that set will predict the correct outcome of the experiment. If one experiment is described by two sets of equations, not being identical, then probably at least one of the sets is not correct and will not give correct outcomes of the experiment. If the other set gives correct outcomes every time the experiment is being executed then that set is probably correct.

If one proves that these sets are not identical then this does not tell anything about neither the experiment nor the universe. It goes wrong when one claimes that both sets, not being identical, describe the experiment correctly. Then the outcomes of the experiment have to be adjusted to both sets of equations. As this cannot be done mathematically it must be done physically. This leads to ideas of non-locallity (action at a distance). And this is physics not being physics. No one comprehends it.

It is much easier trying to find out if one of the sets might be wrong and why. Then both mathematics and physics stay comprehensible. John S. Bell gave in his article 'Bertlmann's socks and the Nature of Reality' two sets of equations: set (3) and set (4), both describing Bell-test experiments. In Bell-test experiments set (4), by Quantum Mechanics, gives the correct outcomes every time the experiment is executed. Set (3), by Bell, doesn't give correct outcomes. This is because Bell didn't realize the significance of the detectors being placed perpendicular in respect of the line of motion of the particles. As a matter of fact no one else realized this. Because of this, vectors in the wrong vectorspaces are being calculated.

It is not very difficult to make the vectorspaces visible. In the experiments opposite spinvectors are somehow being detected by detectors, adjusted at some angle. The detectors are placed perpendicular on the line of motion of the particles. So the experiments solely are concerned with directions. Time, distance, information and things like that have no influence on the outcome of the experiments. Realizing this, it is imaginable to place both detectors on the line of motion at the point where the entangled particles are produced. If both detectors are provided with a central perpendicular plane, then that planes divide space in four subspaces. These subspaces can be visualized as two pairs of opposite vectorspaces.

When a pair of entangled particles is produced, then this pair of particles will have opposite spinvectors, situated in one pair of opposite vectorspaces. It is easy to see that opposite spinvectors, situated in one of the two pairs of vectorspaces, will give as outcome of detection a combination of equal spin results. If spinvectors of a pair are situated in the other pair of vectorspaces, then the outcome will be a combination of opposite spin results.

In Bell-test experiments many pairs of entangled particles are being measured and the outcome is a number of equal spin combinations and of opposite spin combinations. The chance for a certain combination of spin results depends on the difference in angle ($\varphi$) of the adjustments of the detectors. Chances for a certain combination of spinvectors are not proportional to $\varphi$ but they are proportional to $\cos^2(\varphi/2)$.

Particles project their spinvectors in the direction of the line of motion onto the detectors. The average number of spinvectors in a vectorspace is proportional to the size of the vectorspace. So the chance for a certain combination of spin results ( equal or opposite) boils down to the calculation of the projection (in the direction of the line of motion) of the concerning vectorspaces onto the detectors. These vectorspaces are proportional to $\varphi$. When the detectors are placed perpendicularly on the line of motion, the projection of these vectorspaces at the detectors are also proportional to φ. This is probably how Bell calculated his set (3) equations.

But this is not the correct procedure because to the particles these are not the correct vectorspaces. From the perspective of the particles these vectorspaces need to be rotated 90° before being projected onto the detectors. This is because the detectors are being placed perpendicularly on the line of motion. Theoretically this can only be done by starting with the line of motion in the detectorplanes and then rotate the detectors 90° in respect of the line of motion. So from the perspective of the particles the vectorspaces between the central perpendicular planes of the detectors have been rotated 90° and they have to be rotated 90° backwards to become the correct vectorspaces. Although the detectors are being placed perpendicularly only once, this rotation has to be taken into account for every adjustment of the detectors because this rotation is actually executed. Following this procedure the correct vectorspaces are being projected onto the detectors and the chance for certain spin result combinations then is exactly proportional to $\cos^2(\varphi/2)$. And this corresponds to the set (4) equations of Quantum Mechanics from which the correct correlation can be calculated.

This model really can be imagined. One can actually see it with the minds eye. It is like the model for the orbits of the planets. No one beliefs at present that the planets orbit around the earth. One can just look and convince oneself. It is this way because it is, not because someone says it is.

Reference:

1) https://www.youtube.com/watch?v=g1quDMTEIFE (video)