Correlation in Bell-test Experiments and Perspective

Abstract

Applying perspective, projection and a fixed opposite spin, QM correlation is perfectly explicable. Bell's theorem is not applicable to spin detection of entangled electrons because he didn't assume fixed opposite spin of entangled electrons.

In Bell-test experiments spin of entangled electrons can be detected. Entangled electrons move in opposite directions along the line of motion. The spin of the electrons is detected by detectors A and B. The (cross section of the) detectors are placed perpendicularly in the line of motion. The detectors can rotate around the line of motion so they can be adjusted in different angles perpendicularly to the line of motion. They detect spin in only one direction.

Spin of entangled electrons is always opposite. So when detectors A and B are adjusted in the same direction, their result is always opposite spin and when A and B are adjusted in opposite directions, their result is always equal spin. When adjusted in different directions, the result of A and B is equal spin and opposite spin in a definite ratio. This ratio is not proportional to the angle between A and B but to the cosine of the angle. This suggests projection (in one way or another).

So the number of equal spin results is correlated to the angle between A and B. According to QM the correlation is negative inversely proportional to the cosine of the angle between A and B. This is a continuous function with a single function description: fixed opposite spin, projected onto the detector in the direction of the line of motion, for all angles between A and B. Bell, however, found a correlation which is negative inversely proportional to the angle between A and B. This is a discontinuous saw-tooth function, not describable by a single function description. The double function description is: opposite spin result for detectors adjusted in the same direction and vice versa, and for all other angles between A and B: random spin result.

The results of experiments confirm QM correlation, not Bell's correlation. This suggests that entangled electrons have fixed opposite spin (Einstein's view) and not indefinite random spin (Bohr's view).

So what exactly is to be projected?
First a simplified model is described.

One notices that Bell-test experiments take place in one line: the line of motion of the electrons.The only purpose of the experiments is to detect spin directions. For a better picture, everything (the electrons and the detectors as well) is pushed to one point on that line. Of course the entangled pairs still have opposite spin in a random direction. Assumed that spinvectors of all electrons have the same length, their vectortips will form a sphere and the tips are equally distributed on the surface of that sphere

The detectors are provided with an imaginary central perpendicular plane (cpp) perpendicularly to the detection direction. The angle between the cpp's is equal to the angle between the detectors. These planes divide the real space in subspaces: spaces between the cpp's and restspaces. The planes divide the sphere in segments which coincide with the subspaces.

Opposite spinvectors of an entangled pair, situated in the spaces between the cpp's, will give equal spin results and opposite spinvectors, situated in the restspaces, will give opposite spin results. This is easy to see when looked at the component of the spinvectors in the direction of detection. So defining the correlation for one angle between A and B boils down to the measurement of the spheresegments between the cpp's in that angle.

But this will not give the correct results because these spheresegments are proportional to the angle between the cpp's (and the angle between the detectors), as is the projection of the spheresegments onto the detectors. So these spheresegments are not the correct vectorspaces (i.e.

the spaces in which opposite spinvectors are situated that give equal spin result proportional to the cosine of the angle between the detectors).

However, when the spheresegments are being rotated 90 degrees around the detection direction of one of the detectors then they give the correct results when projected onto the detectors. The reason for this rotation is clear when looked at the phenomenon of perspective.

Bell-test experiments don't start with the detection of spin. They start with the positioning of the detectors. One can wonder how the detectors are being placed perpendicularly to the line of motion of the electrons if this isn't done at random. One has to define a plane in space from which the detectors can be placed perpendicularly to the line of motion. Using the line of motion and one of the detection directions such a plane can be defined. Whatever plane is defined, there is always a rotation of 90 degrees involved in positioning the detectors perpendicularly to the line of motion. That rotation has to be taken into account carefully. So from the perspective of the electrons the rotated spheresegments are the correct vectorspaces. And it is the perspective of the electrons that counts because it is that perpsective that QM describes.

Now one wonders of course how two detectors, observing the electronpairs with their opposite spin from two different perspectives, can give the same result as QM gives from one perspective. As is pointed out the defining of the correlation boils down to the detection of the projection of the spheresegments between the cpp's onto the detectors. One of these spheresegments is detected by A. The opposite, symmetrical, segment is detected by B. These segments are both projected perpendicularly (in the direction of the line of motion) onto the detectors. So for the detection of a segment, the direction of the detector makes no difference: the projection of one vectorspace onto one detector has the same size as the projection of the other vectorspace onto the other detector. For that reason the two detectors give the same result as QM.

The size of the vectorspaces, however, is defined by the angle between the detectors (and thus by the angle between the cpp's) but this has nothing to do with perspective.

This model is beautifully demonstrated by the You Tube video: 'Correlation in Bell-test Experiments explained'.

Bell's theorem is not applicable to spin detection of entangled electrons because he assumed random spin. Random spin is not situated in vectorspaces so there are no vectorspaces to be projected onto the detectors. Of course the spinvectors themselves can be projected onto the detectors but that makes no difference: then the chance for two spinvectors to produce equal spin result is again proportional to the angle between the cpp's, not proportional to the cosine of the angle. This is indeed Bell's result.

Bell tried to cover all possible results by adding a factor lambda representing possible hidden variables. But whatever lambda might be, an indefinite random spin can not become a fixed opposite spin. They mutually exclude each other. By assuming indefinite random spin, Bell cut off the only way to explain QM correlation. This is the great importance of his work because with this Bell proved the superposition idea of Copenhagen interpretation to be wrong.

Conclusion

This model gives a local-realistic explanation for the QM correlation in Bell-test experiments as there is no need for information exchange between entangled electrons.

As this explanation is based on the assumption of fixed properties, it means that Einstein was right also on this subject.

As for the uncertainty relations of Heisenberg (Bohr's argument against Einstein's view): they just apply to single particles, not to a multiple particle system.

Gerard van der Ham