Quantum Mechanics and Bell

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Abstract:

This paper shows that the reasoning leading to non-locality of the Universe is caused by the idea that electrons of entangled pairs choose their spin randomly when being measured.
A model exists that perfectly accounts for the QM correlation in Bell-test experiments in a local-real way. It is based on the assumption that entangled electrons have fixed opposite spin. In that case Bell's inequalities are not applicable to spin measurement of entangled electrons so there is no need for a non-local Universe.

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The interpretation of QM is still a problem. Bohr and Einstein clearly had different ideas about it. Bohr stated that quanta have indefinite properties until they are measured. Einstein stated that quanta have definite properties.

Bell thought of a way to answer the question which one of these opposite views was the right one. He discovered that the opposite views should give different results in certain circumstances. And it should be possible to verify this experimentally.

Bell was also able to calculate the differences. In his calculations he started from Bohr's view that quanta choose their properties at random when being measured. Indeed his results were different from QM results. Bell expected Einstein to be right and that experiments would eventually show the results he calculated.

Many years later the experiments actually could be carried out. In these experiments spin of entangled electronpairs was measured at three different angles of relative adjustments of detectors. Surprisingly the results corresponded to QM results, not to Bell's results so Bohr seemed to be proven right and Einstein seemed to be proven wrong.

An additional difficulty was Bell's statement that QM results were not possible in a local universe. Nobody understood how these QM results could come about and one couldn't account for them in a local-real way.

It was an (un)fortunate coïncidence that Bell, having based his calculations on Bohr's view, yet obtained results that were different from QM results. He obtained different results because Bohr's interpretation of QM was wrong, not because Einstein's view would be wrong. His calculations were based on the assumption of random spin of entangled electrons and the establishment of chances of combinations of equal spin came out wrong this way.

The interpretation of QM is totally detached from QM calculations. So if QM mathematics is correct (and there is no doubt about it), QM can give the right results although QM can be misinterpreted. But when Bell based his calculations on these wrong interpretations he got results that did not correspond to QM results. So both QM as well as Bell's calculations are correct but the results of Bell's calculations are wrong because he started from the wrong assumptions, the wrong interpretation of QM (in this case: random spin of entangled electronpairs).

The interpretation of QM by Bohr and others is wrong because entangled electrons have opposite spin (Einstein's view). That is also demonstrated by experiments: measured in the same directions the combination of spin results is always opposite spin and measured in opposite directions the combination of spin results is always equal spin. These results can not be accounted for when electrons choose their spin randomly when being measured. Yet Bell based his calculations on the idea of random spin. He added a factor λ to cover for possible effects of hidden variables. But this was of no use because indefinite random spin and fixed opposite spin mutually exclude each other. The factor λ can't solve that problem whatever λ might be.

However a model exists that accounts for QM results of Bell-test experiments in a local-real way. The model is based on Einstein's view of definite properties (in this case: fixed opposite spin of entangled electrons). The model is based on three assumptions. When one or more of these assumptions is dropped, then Bell's results are obtained. So the model doesn't only account for QM results, it also explains why Bell's inequalities are violated.

Thus the Bell-test experiments appear to have been the perfect instrument after all to answer the question whose view was the correct one: Bohr's view or Einstein's view. It appeared to be Einstein's view although that is still not recognized by many physicists. Most physicists don't believe the previous scenario. They try to explain the QM results with the idea of a non-local universe at quantum level and of quanta that are capable of instantaneous information exchange in an incomprehensible way, although they are far apart.

But this attempt causes problems. Causality is at risk and thus is physics at quantum level. Also the problem of simultaneous random and opposite spin of entangled electrons is not solved. Even if the electrons are in contact with each other in an inexpliccable way, they have to be aware of the adjustments of the detectors. That is not possible: electrons are not aware. So by way of logic (the simultaneous occurrence of each other mutually excluding random and opposite spin views in relation to QM results in Bell-test experiments) also mathematics, the language of physics, is at risk.

Nevertheless the possibility of the fore mentioned model has been demonstrated by Joy Christian in a mathematical way, by Edwin Eugene Klingman in a physical way and by John Hemp in a statistical way. And it is beautifully visualized in the You Tube video: 'Correlation in Bell-test Experiments explained' (https://www.youtube.com/watch?v=g1quDMTEIFE) by