Explanation of quantum entanglement using hidden variables

Jesús Sánchez
Independent Researcher, Bilbao, Spain
jesus.sanchez.bilbao@gmail.com
ORCID 0000-0002-5631-8195

Abstract

In this paper, it will be explained the quantum entanglement using hidden variables. This means, with no need of immediate or infinity range interactions. For this, the solution would be to take into account also the measurement device hidden variables.

These hidden variables of the measurement device will cause that the detection of the particles to be measured, can only be made at certain moments, places and orientations that correspond when the particle states have specific values. This means, the particle state can be changing over time, but the measurement equipment can only detect it when it has certain values (because the hidden values of the measurement equipment are also participating in the process). So, the measurement device is participating indirectly in the entanglement of the particles.

The problem until now with hidden variables interpretation was that only the hidden variables of the particles were taken into account. But, once the measurement device hidden variables status is considered also, the issue can be solved.

Keywords

Quantum entanglement, hidden variables, quantum mechanics interpretations

Introduction

If we create two particles in a laboratory, we know that they will be entangled [1]. This means, if we measure a property in one of them, the property of the other one will become known (typical example is that it will have opposite spin compared to the first one). Currently, the explanation for this, is that when we measure the first one, a process occurs (immediately with infinity range) that makes the other one take the only possible value (in the example, the opposite spin).

In this paper, I will comment that if we take into account hidden variables [2] (a hidden property) not only in the particles but also in the measurement device, this effect can be explained.

1. Hidden property

What the hidden property is, it really does not matter. The only needed thing at this stage is to know how it can affect the measurement. So, imagine (it is just an example, a simple model) that the hidden variable can be represented by a rotating vector. This vector represents a property of the particles and it is related to a type of interaction. But, as all the particles interact among them, after a while, this rotating vector is synchronized (meaning for example that they rotate parallel with the same speed) for all the particles in the surroundings. So, in the end, all the particles in the same vicinity have this rotating vector synchronized (for example, to avoid the creation of forces, as having different directions of the vector could create some interactions).

So, let's say that we are in a room with a laboratory machine. As all the materials in the room have been sharing a lot of time with all the particles of the planet, and of course of the room, we can say that this rotating vector of the hidden property is synchronized for all the particles in the room (we, the table, the lab machine…).

The issue is, that this property at this stage is invisible. As everything is synchronized, we cannot see any effect coming from it.

2. Creation of two particles entanglement

Now, we create two entangled particles in this laboratory. As they are entangled, we know that they will be correlated in the value of whatever property (they will have opposite spins for example). Now we measure the spin in one of them. The spin in the second one becomes known, and we know that whenever we measured the second particle, the spin will the opposite.

But, is this magic or could have an explanation? It can have an explanation, as follows.

As commented, let's imagine that the rotating vector commented before (it is a model of whatever hidden variable) has a role in the detection of the particle. This means, the particle cannot be detected until the rotating vector of the measurement device and the particle rotating vector have whatever relation (are parallel or anti-parallel, form whatever angle). This means, the machine cannot see the particle until this effect occur. The machine can only detect the particle at certain places, in certain moments and at certain orientation for this to occur. Finally, it will detect it, but the detection will be discrete, it can only happen at certain moments and places where the properties of the particle are somehow synchronized with the measurement equipment. The properties of the particle will change over time, but we will only detect the particle when these properties have some specific values.

Now, let's go to the second particle. We are going to measure it with the same device or with one very near it. This means, both devices are synchronized regarding this hidden variable (the example of the rotating vector). It does not matter if we have measured the first particle or not. When we measure the second particle, we have the same problem. We can only detect it at certain moments, in certain places and orientations (to be able to interact with this property of the measurement device) and at these moments and places, the values of the particle are some specific. In this example, the spin will be opposite to the first particle. But as commented, it does not matter if we have the information of the first particle or not.

jesus.sanchez.bilbao@gmail.com
ORCID 0000-0002-5631-8195

If we have the information of the first particle we can advance the result for the second. But the result for the second will be the same if we have measured or not the first one. The entanglement is not only related to the two particles, but also with the measurement device.

3. Possibility of verifying this

The only way to verify this, would be to use two different detection devices but that are not synchronized. If they are not synchronized, we will not measure an entanglement in the two particles (as the other needed entanglement/synchronization with the measurement device does not exist). This means, we should know which the hidden property is (if for example, it is something that can be manipulated electromagnetically, we could try to apply a magnetic field to one of the two devices before the measurement) and desynchronize on purpose both devices. The other possibility is to bring an equipment from far away, very quick, hoping that there is no time for synchronization with the other equipment (but this really seems not feasible, for sure all material in earth is already somehow synchronized regarding this hidden property or will get synchronized during the installation time).

4. Conclusions

In this paper, it has been presented a model that permits quantum entanglement with hidden variables. If we consider the measurement instrument hidden variables (not only the particle ones), the detection could be forced to be done only at certain moments and certain places when the particle present specific values of its properties.

This gives as a result, that we measure entangled properties for both particles. But because the measurement device is also participating indirectly in this entanglement (via its own hidden variables).

Bilbao, 1st May 2018 (viXra-v2).

5. Acknowledgements

To my family and friends.

6. References

[1] Audretsch, Jürgen "Entangled Systems: New Directions in Quantum Physics.", Wiley-VCH.
[2] Genovese, Marco "Research on Hidden Variable Theories: a review of recent progresses", https://arxiv.org/abs/quant-ph/0701071

jesus.sanchez.bilbao@gmail.com
ORCID 0000-0002-5631-8195