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Entangled States

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It is an experimentally proven fact that any physical entity –be it alive or not- has two intrinsic properties: these are the wave and the particle aspects. This means that all matter is both localized and also non-localized in space. It becomes localized when we collapse its wave aspect by observation. If we do not observe that entity it may or may not exist. That is; we can only talk of a certain probability of existence for any object.

Einstein used to say: "The moon exists even if nobody observes it", but what does such a statement entail. The logical consequence is that there is a reality independent of the observer and that all objects are independent of each other. Quantum Mechanics (QM) refutes this claim. According to QM once two objects interacted with each other their wave aspect becomes entangled. This entanglement does not disappear either with long distance, or with elapsed time.

Experiments done on correlated photon pairs has shown that each photon knows what its distant partner does, and does the same thing [1]. We see that once a certain interaction has occurred, its effects will continue to exist non-locally. Non-locality means that an instantaneous, faster than light, information transfer happens between the two entities.

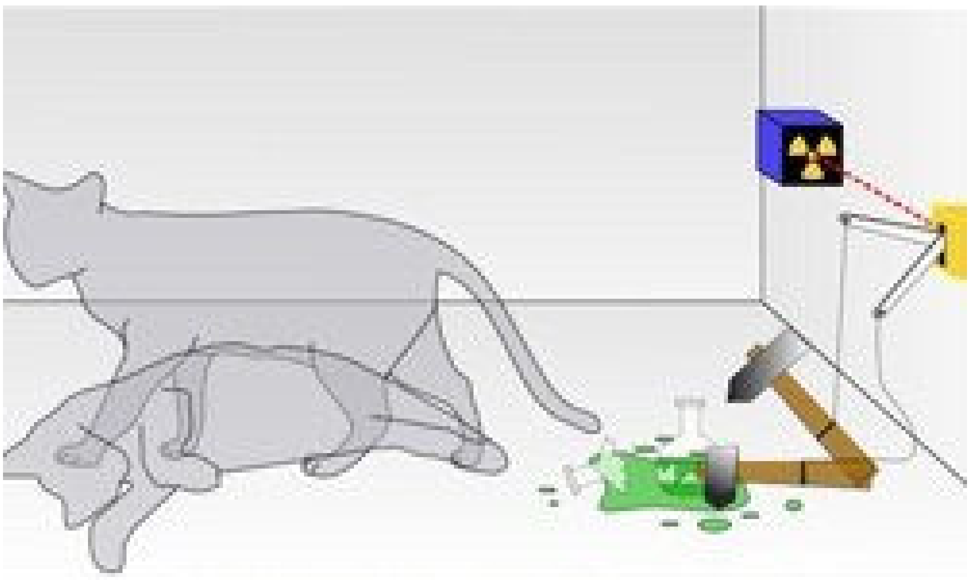
Such a correlation cannot be explained with local realistic theories. But the model which I propose says that there is a wave which travels faster than light, back and forth between the interacting particles. Thus my model can be called a **non-local realistic** theory. The realistic part comes from the fact that we can be sure –with a high probability- that a certain outcome will happen. As an answer to Einstein's claim, I will say: "The moon exists with a high probability even if nobody observes it".

The "high probability" comes from the fact that our claim does not rest on a single observation but on many consecutive ones. But even if we observed and saw the moon for a million times, we cannot say for sure that it will still be there on our next observation. There is always a very small probability that it may not appear. Any statement on reality and existence can only be claimed with a certain probability. As long as we do not make an observation this probability can be neither zero nor hundred percent. Our claim should always contain a margin of uncertainty.

Claiming that a certain outcome **will happen** with zero or hundred percent probability means that we believe in local realism. The result of any outcome settles to a hundred percent probability only **at the moment** of observation. This is the accepted interpretation of QM, which came to be known as the **Copenhagen Interpretation**.

The Copenhagen Interpretation is Niels Bohr's (1885-1962) explanation on what **reality** is. He said that we cannot be sure on 'what really is' until we have made an observation. This is true at all scales, be it at the level of atoms or at the level of our daily experience. A famous example is the **Schrödinger's Cat** thought experiment.

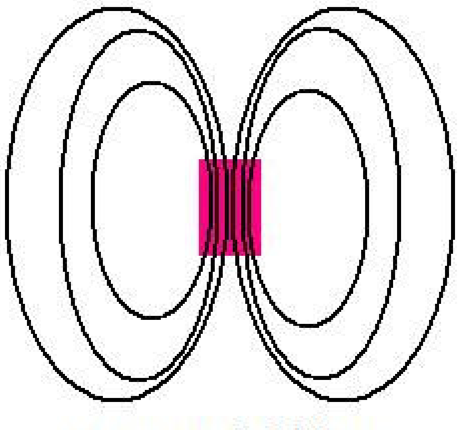
A cat is placed in a closed box together with a device that will trigger under the influence of a radioactive disintegration. A beta particle (an electron) will activate the mechanism that will break a bottle which contains a poisonous gas. The gas will kill the cat inside the box. Since there is a certain probability that the electron may or may not be ejected from the radioactive material we cannot say for sure that the cat is dead or alive inside the box. The situation is depicted in the picture below.



Until the door of the box is opened the cat may or may not be dead. This means that there is a 50% chance of the cat being alive and 50% chance for it being dead. The outcome of single events is unpredictable not only according to QM but also according to our daily experience. Does this means that the future is unpredictable? No, but it means that we can never predict the future from a single event. We need a set of events that have given the same result in order to make a prediction with high probability.

For example, we can never tell if a coin tossed in the air will fall as head or tail. While it is in the air the probability of head or tail is 50%. Once it falls on a flat surface the probability becomes 100% for one side and 0% for the other side. This is known as the **collapse of the wave function**. While the coin is in the air its state is similar to an indefinite wave. That is, it does not have a localized and definite observable local state. Once the coin falls on a flat surface the wave function collapses and the state settles to a fixed local value. Thus observation collapses the wave aspect of reality. As long as we do not observe a physical system or object the wave aspect prevails. As soon as we observe it, its particle aspect appears.

This situation is exactly the same as depicted in chapter **6-Baryons and Leptons**. All matter exists in a **non-local, 4-dimensional fractal energy field**. All parts of the field are connected to all other parts and information is transmitted with the intermediary of energy waves that spread all over the field with a speed that exceeds the speed of light. These waves are the T-waves postulated in the present model of the universe. The T-waves are inside and around us, as well as in and around all material objects. Exactly like magnetic force lines being both inside as well as around the red magnet as shown in the picture below. These force field lines are recursive and self similar.



Magnetic field lines

[1] **Quantum Spookiness Wins, Einstein Loses in Photon Test,** Andrew Watson, Science Magazine, 25 July 1997, Vol. 277, page 461.