Quantum teleportation: a hypothetical concept

*Raktim Datta[1], Suryakanta Chatterjee[2], Ishan Banerjee[3], Debayan Bose[4], Sneha Dutta[5], Arnab Basu[6]**

Department of Basic Science and Humanities, Institute of Engineering & Management, Kolkata-700091,

Email: arnab.basu@iemcal.com*

Abstract

Quantum Teleportation is a hypothetical but logical application of Quantum Entanglement, which is basically a non-classical and strange phenomenon. It involves instantaneous communication between two very far situated particles through any non- perceivable link and can be considered to communicate more than the speed of light, and this fact holds the power to stand against Einstein's General Theory of Relativity. Here the 'Hidden Variable Theory' comes into play, and there is a synchronisation between the variables in such a way that leads to their communication. But, whenever there is a simultaneous result from a particle in response to an event occurring on the other particle, it violates 'The Principle of Locality'. Evidently, there has to be some connection through other spatial dimensions as predicted by the String Theory. It can also be true that, entangled particles take shortcuts for communication across universe which is generally referred to 'Space-time Wormholes'. Magnetic wormholes have been created till date by manipulating electromagnetic fields, but Space time wormholes are yet to be discovered. Logically, such kind of wormholes can be created only by manipulating the mysterious 'Gravitational Waves' which possesses extraordinary characteristics of producing rhythmic but alternate expansion and compression in the Space-time fabric, of intensity equal to the frequency of the wave. As these waves create distortion in space-time fabric, it results in change in the speed of light with respect to time. So it might be possible that entangled particles communicate at a speed higher than that of light which is beyond perception. It might also be possible that the universe is 'SuperDeterministic'.

Keywords: *Quantum Entanglement, Wormholes, The Principle of Locality and Realism, Gravitational waves, Space-time fabric, Quantum Teleportation, Quantum Electrodynamics, Theory of Relativity, EPR Paradox, String Theory, Hidden Variable Theory.*

1. Introduction

In Quantum Teleportation the particles do not move from one place to other but the quantum state shifts from initial particle to the final particle. The particles share the same spatial area with a considerable distance between them, but the quantum state of each individual particle cannot be described separately, but can be described for the system as a whole. The entangled particles always have opposite properties. Basically, a Quantum particle does not exist at one state but in all of it's possible states at once.

According to EPR paradox, quantum mechanics is not a local theory, because when a measurement is made on one of the entangled particles', it causes an instantaneous opposite effect on the other. This suggests that there is a collapse of the probabilistic wave function of the remote particle (i.e. an effect exceeding the speed of light) [1]

2. Development:

"Quantum Entanglement" is a term in quantum theory which describes the way in which the particles of energy or matter interact with each other, no matter how far apart theyare. [2]
It involves transfer of 'quantum information' from one particle to another, and it happens at more than light speed. But according to Einstein, nothing can travel faster than the speed of light, and if it does so then it will violate various physical laws.Hence here, we have four hypothetical possibilities which are although likely to be logically correct but yet to be proved:-

2.1 First hypothesis (hidden variable theory)

Time is not absolute but time is relative. This idea forms the basis of the Space- Time theories. Experimental tests of the Bell's inequality, which shows that quantum mechanics seems to violate the inequality, so it must violate either the principle of Locality or Realism. Einstein's principle of local realism is the combination of the principle of Locality (limiting cause-and-effect to the speed of light) with the assumption that a particle must objectively have all the probabilistic pre-existing real values before the measurement is even made. Hence we can say that the 'Hidden Variable Theory' is applicable here, which was supported by EPR paradox. As the particles are separated by a distance,the particles must contain some hidden variables whose values effectively determine, right from the moment of separation that what the outcomes of the spin measurements are going to be. Hence, we can say that the entangled particles already carries all the possible required informations with it and nothing needs to be transmitted from one particle to the other for communication, at the time ofmeasurement.

2.2 Second Hypothesis :(Predictions by String theory)

Quantum entanglement is a very strange phenomenon and the most fascinating fact about it is the communication between two particles at a large distance with an extraordinarily high non-perceivable speed. So as per the prediction of String theory, we happen to exist in a space-time fabric consisting of 11 Dimensions and the whole universe consists of strings and each vibrates at a slightly different rate, so we cannot perceive them. Due to the change in vibrational rate of the strings, it may jump out of phase in our universe, into phase on another, and then back into phase in ours. And it is possible that at resonant frequencies, the string produces subatomic particles, with different particles having unique resonant frequency values. These particles can flash into existence in our universe, then flash into another universe, and then flash back into ours. In this way, signals can pass between dimensions, and hence we cannot perceive the pathway for information transfer between two entangled particles. [3]

2.3 Third Hypothesis :(Gravitational Waves and Wormholes)

The third possible way for the mysterious connection between two entangled particles can be through the Wormholes, which are the tunnels in the Space-time fabric. Wormholes can be used either to travel to other hypothetical Dimensions or may be it can also be used to travel in either direction of Time. [4]

Hence it can be possible that this wormhole serves as a pathway for connection between the two entangled particles, and therefore the particles are able to communicate instantaneously. But creating or finding such a wormhole is beyond human intelligence till date. Logically it is possible that if we can manipulate the Gravitational Waves then definitely we will be able to create our desired Space-time Wormhole. Perceivable amount of Gravitational waves are generated only when there is an acceleration of very high and compact mass, then ripples are created in the space time fabric, which are referred to as Gravitational waves. As Gravitational waves has a very strange property of causing rhythmic distortion in the space-time fabric which was found to be true by the experiment conducted by LIGO (Laser Interferometer Gravitational-Wave Observatory). A similar kind of an experiment is cited below asexample:

Experiment:-

If we choose three points on Space-time fabric, suppose A, B, C where, line BA and BC are perpendicular to each other. Then if we have one laser source and a beam splitter, such that the source is at B and the beam is split into two paths, first part towards A and second part towards C. Now if two detectors are placed at A and C respectively, and if Gravitational waves pass through that region then it is found alternately that light does not reach the two detectors at the same time. Either the detector at A detects the laser first and detector at C detects it a bit later or vice versa, and hence this continues alternately as long as the wave is passing through that space timefabric.

2.4 Fourth Hypothesis :(A super-deterministic Universe)

And the last probable possibility about the deep secret of the communication path between two entangled particles can be that the universe is 'super deterministic', that means every single quantum interaction in the entire lifespan has been already pre- defined since the moment of the Big Bang, and pre-destined since the beginning of time. If it is so, then likely we can say that maybe we are living in a 'Big Super Computer' where everything is predefined just like a computer program and we are the objects of such a program executing gradually with time. Hence, maybe it is already known to the entangled particles that how to behave according to time, as it is already pre-programmed from beforehand. [5]

3. Result anddiscussion:

According to the 'Cosmic Bell Test' and 'Heisenberg's uncertainty principle', if we do not measure a particle and let them remain undisturbed, then they would behave as if they have a whole set of different values at the same time but the more we approach to measuring a particle to know about its position and speed then the wave function of the particle gradually collapses and as a whole there it gives out a single valued outcome. It is either, that the particles are switching to different values as per their hidden variables among those two particles which are synchronized just like watches more than the speed of light or else they are communicating more faster than the speed of light through wormholes or other dimensions, else we are bound to accept that the universe is super-deterministic. Thereby violating 'Relativity' and the 'Theory of Non-Communication'. But the Bell's test still gives the same graphical curve which logically suggests that all the entangled photons exists in the same time with different values and can communicate with each otherinstantaneously.[6]

It can be true that Einstein's Theory is applicable everywhere except for world of Quantum Physics where there is no sure result and only the probability function reigns supreme in giving out theresult.

Hence a lot of secrets of the universe can get revealed once we can learn to manipulate the Gravitational Waves and successfully teleport particles.

4. Conclusion

It might be possible that wormholes do connect black holes in space, possibly providing a clue to the mysteries of quantum entanglement and how to merge general relativity with quantum mechanics.
Hence by manipulation of gravitational waves we can control the speed of light, and hence we may also travel through time if we achieve a speed greater than that of the speed of light.

REFERENCES

[1] Einstein's 1935 papers: *EPR=ER? Gerd Ch.Krizek11University of Vienna - Faculty of physics* - Quantum particleWorkgroup1 UAS Technikum Wien - Department of Applied Mathematics and Sciences April 18,2017.

[2] Asher Peres, *Quantum Theory, Concepts and Methods,* Kluwer; I SBN 7293-2549, page-115.

[3] General I Article *Space and Time: From Antiquity to Einstein and Beyond* by AbhayAshtekar.

[4] *Wormholes: Space Machines and Time Machines*. Dr. Andrew Friedman –MIT

[5] *Experimental quantum teleportation of a two-qubit composite system* Qiang Zhang, Alexander Goebel, Claudia Wagenknecht, Yu-Ao Chen, Bo Zhao, Tao Yang, AloisMair, JörgSchmiedmayer&Jian-Wei Pan Nature Physics 2,678–682.

[6] Andrew Whitakar "*The New Quantum Age :From Bell's Theorem to Quantum Computation and Teleportation*", Oxford UniversityPress(2004).