

# QUANTUM ENTANGLEMENT AND EPR PAIRS:

## QUANTUM ENTANGLEMENT:

Quantum Entanglement is a phenomenon in quantum physics, where pairs of particles are created or are separated such that the quantum state of one particle being measured directly influences the quantum state of the other particle being measured. Prior to the measurement, the pairs under consideration (unlike classical quantities) are in a superposition of all possible quantum states.

For example: Person A and Person B have an electron each with them. They do not know what spin it is has, as the spins of both exists in a superposition of spin up and spin down. Person A measures the spin and it turns out to be up. When Person B measures the spin, it is also up. If both people A and B are in different rooms (say), and they return later to reveal the spins, they notice that it's the same 50% of the time and different 50% of the other trials. It's almost as if the electrons had a means of communication with each other and decided to align in a certain way with respect to each other.

## EPR PAIRS:

EPR pairs are pairs of qubits that are in a Bell state (quantum states (a specific one) that represent the simplest examples of quantum entanglement) together. Because of quantum entanglement, one qubit being measured simultaneously assigns a value to the other qubit. The value assigned to the other qubit is one of four basis states given by  $|00\rangle$   $|01\rangle$   $|10\rangle$   $|11\rangle$ . In the case of one Bell state (taken as example)  $\frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$ , the probability of measuring  $|00\rangle$  or  $|11\rangle$  is 50% each in this state.