

Quantum Entanglement and the EPR pair

An EPR pair is a pair of quantum bits (qubits) that are maximally entangled. Quantum Entanglement, in simple words, means a correlation by which two or more particles communicate, that is knowing the properties of one particle of the entangled pair, the properties of the other can be deduced.

For instance, consider a situation, that an unstable spin 0 particle decays into two particles A and B which move in opposite directions. Then, the sum of the particle spins of the two particles must be 0. Say now that the spin of particle A was measured and found to be $\frac{1}{2}$. Then without even measuring the spin of the particle B, it is possible to tell that particle B has a spin $-\frac{1}{2}$. It is as if particle B knew instantly the spin of particle A. It is as if the two particles communicated instantaneously. This was called as 'Spooky action at a distance!' by Albert Einstein.

An EPR (Einstein-Podolsky- Rosen) pair is one which is in perfect quantum correlation. Due to this property they are used in quantum computing. Knowing the state of a particle (quantum information) the state of a particle previously entangled with it, can be exactly known. This increases the efficiency of computation.