

Entanglement

Quantum entanglement is a special connection between two qubits. There are many ways to generate entanglement.

One way to produce it is by bringing two qubits close together, perform an operation to entangle them and then move them apart again. When they are entangled, you can move them arbitrarily far apart from each other and they will remain entangled. This entanglement will manifest itself in the outcomes of measurements on these qubits. When measured these qubits will always yield zero or one perfectly at random, but no matter how far away they are from each other, they will always yield the same outcome.

Entanglement has two very special properties that enable all the applications derived from it.

The first property is that entanglement cannot be shared. If two qubits are maximally entangled with each other, then no other party in the universe can have a share of this entanglement. This property is called the monogamy of entanglement.

The second property of entanglement, which makes it so powerful, is called maximal coordination. This property manifests itself when measuring the qubits. When two qubits that are entangled are measured in the same basis, no matter how far away they are from each other, they will always yield the same outcome. This outcome is not decided beforehand, but it is completely random and is decided when the measurement happens.