Knowledge Racer

Lyrics

Entangled qubits defy the rules of common sense.

Environment will not ruin the operation.

Are you here, are you there at the same time?

In the microscopic universe, this is true.

But in a classical system this cannot be.

The quantum superposition of atoms, explore all possibilities at an instant.

Flipping bits near the speed of light.

Dive into a world of information and learning.

A pool of multi-shaded glass.

Is there a task too great for Knowledge Racer?

An ability to solve any problem in the physical domain.

Decoherence cannot ruin the solution.

Knowledge Racer.

Knowledge Racer.

Knowledge Racer.

Knowledge Racer.

Look at the screen and you will confirm, that you are free to develop your mind.

No puzzle is too demanding for the Knowledge Racer.

Meaning

The above song is about the “Knowledge Racer” (a quantum computer).

The Knowledge Racer is the most powerful computer ever created and is based on the principles of quantum mechanics.

A quantum computer derives its power from a concept called “superposition,” as opposed to the computers we use today, which are based on classical physics--classical physics applies to the macroscopic realm (the world of large objects).

When classical physics based computers make calculations or run algorithms they do so based on unit of information called a “bit”--a bit is a binary entity, it is either in the state of 0 or 1 but not both at the same time. Each calculation is carried out separately and in sequential order, one after another.

A quantum computer, on the other hand, manipulates a unit of information called a “qubit,” which stands for quantum bit. A quantum bit can be in a state of 0, 1, or both 0 and 1 at the same time--thus a qubit can be in two different states at the same time--there is no analog for this type of behavior in the classical world, we cannot be in 2 places at the same time (macroscopic objects cannot be in 2 states at the same time).

The ability to be in two different states at the same time is common in the microscopic realm (quantum world) of atoms and subatomic particles such as electrons and protons--this also includes photons (light particles) but they have no mass, unlike electrons and protons.

The concept of superposition allows qubits to be in 2 different states at the same time. Thus, quantum computers derive their power from the fact that they can explore all the different possibilities for a given solution at the same time rather than following the sequential route typical of classical computers. Furthermore, for quantum computers to run properly they must avoid “decoherence.”

Decoherence is generated when qubits interact with the environment around them--thus qubits must be separated from their environment when performing calculations, if they are not separated from their environment the system collapses and the computation reverts to classical principles based on sequential processing.

“Entanglement” refers to the idea that all atoms and sub atomic particles in the universe are connected in some way. An experiment was carried out in the early 20th century, where 2 electrons were separated from one another to measure their “spins.”

The scientists discovered that when they measured the spin of one electron (spin up), the other electron instantaneously measured spin down. The “communication” required between the two electrons to generate the coordinated activity would mandate a speed of information transfer greater than the speed of light, which is the speed limit of the universe. Speeds beyond the speed of light are not possible, but the concept of entanglement is real and well established. However, scientists are still arguing about how to interpret the phenomenon.

Einstein described the process as “spooky action at a distance.” Entanglement is useful in quantum computing because it allows qubits to “share” information resources much more efficiently, thus allowing the system of computation to increase information processing speed in a massive way.