THE NEWEST FRONTIER

Quantum Computer

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Quantum computer is a totally new type of computer. Its calculating is based on the quantum physics. Quantum computer is using a quantum bit instead of the normal one. This quantum bit is the biggest feature of this computer.

So, what is a quantum bit? Here, Quantum bits specialty is that they can be a "1" and a "0" at the same time. We call this mysterious state the quantum superposition. This allows us to calculate millions of patterns at once.

Look at the slide. The 3 classic bits are able to take 8 patterns, but not at once. Compared to this, 3 quantum bits can take all 8 patterns at once! Each pattern possibilities will be expressed by a "wave". This IS the basic logic that quantum computer uses. Sounds easy right?

So, then what is the bottleneck of making quantum computers? We still have the most difficult step left. HOW do we make an actual quantum bit? Today I've brought 4 answers of this question.

First, we can make a quantum bit using the superconductivity. When we connect 2 superconductors sandwiching a very thin insulator, the electrons inside the superconductor will be able to go THROUGH the insulator. Now, defining that if the electrons are in the left it's a "0" and if they are in the right it's a "1", we can use the electrons position as a quantum bit! Using a microwave, we can change the electrons position and even make them take the state of superposition, too. This is the most popular way to make a quantum bit these days.

The second is using an ion trap. Ion trap is a technology to trap a single ion in the air. By applying high frequency AC voltage between the electrodes, we can make a vibrating electric field. In this field, there's one line that the resultant force will be 0. When we put an ion on this line, the ion will just flout there and never move. If you want to put 2 or more, you'll need a VC voltage as a lidto keep ions in line. After the ions are lined up, we can give them potential energy using a laser beam. Defining the high potential as "1" and the low potential as "0", it's already a quantum bit! They can of course take the state of superposition by the laser beam too. By the way, I'm actually thinking this ion trap will be the best way to make a quantum computer.

The third is the semiconductor. It is similar to the ion trap, but in this case, we'll trap a single electron inside the semiconductor. Using metal electrodes embedded in the semiconductor, the electron will be trapped between them. This time the "1" and "0" will be the spinning direction of the electron. It's able to control by changing the voltage between the electrodes, and it can take the state of superposition too.

The last way is using photons. Photon is a fundamental particle of light. In this kind of microscopic world, the particle will start acting as a wave. Defining the vertical wave as "1" and the horizontal wave as "0", the photon can be a quantum bit. In addition to this, photon has some interesting features. The biggest one is that the photon cannot stop! Therefore, if we want to hold the date that the photon has, we somehow need to loop the photon forever until we use the date. One more interesting thing is that we use a special mirror to make the photon take the state of superposition. This mirror reflects light in 50%. Photon cannot be divided anymore, so the THING comes out or reflects will be a photon taking the state of superposition.

Making quantum computer is a rocket science and it will definitely require a long time, but that's my dream and I know that I'll never give up.