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Who will set quantum computers?

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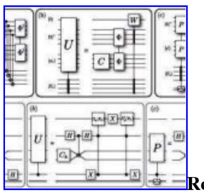

Revolutionary computing

The **promising quantum computers** are proving more difficult to be achieved than imagined at first.Moreover, once built, it seems that their use will be much more revolutionary than expected.

It is common to refer to quantum computers as a new generation, so to speak, **"super supercomputer"** capable of doing all that classical computers are today, only more quickly.

But that's not all. Quantum computers are for classical computing and quantum mechanics is to classical mechanics.

And strange things – but extremely helpful in every way – they occur in the quantum world.

Quantum programming

In a classical computer, the programmer is concerned to see whether each bit has value 0 or 1. In a quantum computer is a quantum bit, or qubit, can represent 0 and 1 at the same time – two qubits can represent four **values simultaneously,** three qubits eight, and so on.

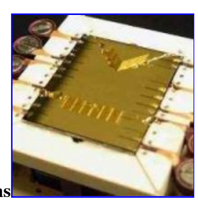
If, on the one hand, many teams around the world are trying to understand the fundamental principles that will allow the construction of quantum processors, some teams have begun to worry about how to make programs for them.

Only in 2009 was built the **first programmable quantum** processor – but run some routines is a logical thing, and build a complete quantum algorithm is quite another.

Not only that the task is difficult: it seems to defy common way of thinking.

For example, **using the phenomenon of superposition**, scientists showed that a quantum program can find information in a database without even needing to run the program:

Quantum computer solves problem without running program

Quantum simulations


And quantum computers are becoming a necessity, as science advances in understanding and using ever more intensely on the quantum scale phenomena.

The simulation of quantum phenomena – through the solution of the equations of many-body

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Schrodinger – has applications in developing **new drugs and understanding** of superconductors, for example.

But using today's computers, the equations of many-body Schrodinger may not be resolved for many bodies.

And the results are only approximations, and scientists want to get closer to these approaches, and advance to more complex problems, for example, trying to understand photosynthesis in order to create mechanisms for artificial photosynthesis that can solve the energy problem in the world.

A wonderful problem

And quantum computing is not accelerated parallel computation.

There is a fundamental problem when trying to simulate quantum mechanics on a classical computer: the so-called "signal problem".

In quantum mechanical calculations, one should take into account not only the probabilities, but the scale of probability – and these amplitudes can become negative.

Richard Feynman called it all a "wonderful problem":

"I'm not happy with all the analysis using only the classical theory, because nature is not a classic, man. And if you want to make a simulation of nature, it is better to do with quantum mechanics and, wow, this is a wonderful problem, because it does not look easy. "

Metropolis quantum

Now, thirty years after this statement Feynman, a group of theoretical physicists from Austria, Canada and Germany, showed that, in fact, the changes of a quantum system can be reproduced on a universal quantum computer.

For this, they created a quantum version of classical **classical Metropolis algorithm.**

This algorithm was developed by Nicholas Metropolis in 1953 and remained a curiosity until the advent of computers.

The classic version of the Metropolis algorithm that uses stochastic maps over several iterations, converge to an equilibrium state. Included in the so-called Monte Carlo method, this is one of the algorithms commonly used today in physics for the expected value of a system being simulated.

To create the quantum version of the **Metropolis algorithm**, the team used only completely positive maps, instead of probability amplitudes. This brings problems such as errors in calculations when introducing quantum phase transitions.

Still, the implementation of quantum algorithm may have important applications in the fields of chemistry, condensed matter physics, high **energy physics** and to solve the Schrodinger equation for more complex systems, where many particles interact.

"While implementation of this algorithm for quantum many-body problems on a large scale is out of reach with today's technological means, the algorithm is scalable for system sizes that are interesting to real physical simulations," say the researchers.

Developers quantum

What should be noted, however, is that the group showed that the effort to build the hardware of quantum computers will be well paid: a quantum computer, using this algorithm, can be used to solve the "problems wonderful" Feynman's exponentially more faster than current computers.

And solutions to the Schrodinger equations are finally within reach, dammit.

In the future, the article describes the creation of **Quantum Metropolis** is perhaps remembered as a milestone in the programming of quantum computers.

What makes us ask, who will face the problem of wonderful programming quantum computers? Or write an assembly Quantico? Quantum or a C?

The fact is that Feynman still seems right: it does not seem easy.

Created the first quantum simulator

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Revolutionary computing, using the phenomenon of superposition, values simultaneously

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