We do that together with electrical engineers, and we make these chips that you see here in the last shot. This is an electronic chip that has a whole bunch of qubits on it.

Nowadays, we can make between five and ten cubits on the chip, and program and control it. We think that we need another ten years or so to make circuits that are big enough to really solve the relevant problems, and have an illustration how it will go, how it will develop from there.

Suppose that we take for instance, the biggest supercomputer that we have nowadays in the world, it's in U.S. It's called the Titan. This computer is actually as big as this concert hall. If I want to make this computer two times faster, what I have to do is I have to make it two times bigger, two concert hall.

If this were a quantum computer, it's the same starting point. Then in order to make it two times faster, I only have to add one cubit to the supercomputer, and one cubit is very tiny, you can't even see by the naked eye.

So every time, you're adding a qubit to the quantum computer, it becomes two times faster. That is because the computational power of a quantum computer scales as an exponential. It's two to the power of the number of qubits.

Exponentials are difficult to understand, but let me try to illustrate it with a number example. I have to go offstage for this example, actually. If I — I'm a linear machine, if I start to give handshakes to everybody in the audience, then you know it's a linear process and I need ten steps in fact, to give ten handshakes, and I need two, four more. I do this linear, I'm a classical machine.

Suppose I could go into a superposition, then in ten steps, I actually can shake two to the power ten, that is 1024 hands. So in the same sequence, I would have given everybody here in the concert hall a handshake. That is the difference between a classical computer – a small section, and a quantum computer – everybody in the concert hall.

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So we're not talking here about some incremental improvement of computing speed. This is really a revolution in information technology. It's a game-changer.

Funny enough and lucky enough, it's nature that actually helps us to develop this quantum computer, and that brings me back to my leaf.

In the photosynthesis reaction, that happens in between the light input where it actually releases electrons in the leaf, that have to find a way from their starting point to some specific end point, where they can release the oxygen.

And in between, there are many different paths for the electron to take to go to the site where it can release the oxygen. Luckily, the electron can go into a superposition, and as in the labyrinth problem can find the end state very quickly, and produce you know, the oxygen for us very efficiently, so our bodies are kept together. We breathe oxygen, all because of superposition, and that brings me to my take-home message: Nature uses quantum mechanics to compute.

And we quantum engineers, have started to begin to make programmable quantum computers, and help solve some of our Earth problems. So I hope that with a quantum computer that we will live better lives. and be more careful with our resources on Earth.

Thank you very much.

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