Introduction to the quantum computer

What is the greatest technological achievement of mankind?

Many would answer it is the landing on the moon in the 1960's.

And yes, this was a remarkable achievement but the fact that we can integrate billions of transistors on a single chip; that really changed our everyday lives.

Nowadays integrated circuits are everywhere around us, in our cars and in our phones. And even in this journey to the moon, computers played a vital role.

Quantum computing is now in a very similar stage as those days of the 1960's.

Computer engineers had to solder components all one to another, if you have ten components, this is ok. But once you go to the thousands and ten thousands, this is a very complicated task.

Now if you ask me what is the biggest challenge for quantum computing, it is to go from this small qubit application to a large scale system.

I think we are only beginning to understand what a quantum computer can do. But of the applications we know the ones that motivate me most, are to compute the behaviour of molecules and materials, which in turn can have really important impact in designing new medication, new drugs, better energy storage, energy transport and so forth.

A future quantum computer will exist out of many layers. A layer will be the qubits, but also think about the compilers, software, a quantum algorithm. And all those layers; they need to communicate with each other. It really requires a lot of creativity that problems and solutions that you are implementing on one side are complimentary to complete the other side. And solving this big puzzle is really what excites me.

So over time I have gotten used to working with one single electron, and holding on to it and manipulating its quantum state and doing computations with it. But when I pause to think about it, it is really quite amazing.

So this course we created for people who want to understand how the most profound aspects of quantum mechanics have the potential to revolutionize the world.