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Science AMA Series: Hi Reddit, we're a team of physicists at the University of Sussex who recently revealed the first ever blueprint for a large-scale quantum computer. Ask us anything!

WINFRIED_HENSINGER [R/SCIENCE](#)

Hi Reddit, I'm Professor Winfried Hensinger, and me and my team at the University of Sussex are working on constructing the world's first large-scale quantum computer – the most powerful computer in the world.

We've recently unveiled the first practical blueprint for how such a computer could be built. The paper, [Blueprint for a microwave trapped ion quantum computer](#), can be found in the journal Science Advances. You can read our [press release](#) for more information. We'll be holding [a special event at London's Spitalfields Market](#) on 11 July, where the public will be able to explore a virtual quantum technology laboratory and meet some of our research team.

We'd love to talk to you about anything to do with quantum computing or quantum physics. We'll be back at 6pm GMT (2 pm EST) to answer your questions, ask us anything!

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Hey! What would your advice be to early university/high schoolers who are eager to get involved in the development of this field? Is there a large need for pure researchers to come through or is there a need for an engineering approach to bring this technology from theory to reality? Thanks for your time!

[the_omnomnivour](#)

If you're at high school, you can't go wrong with a strong maths and general science background! Don't be afraid to also do things like electronics and computer science as these are also incredibly important. Follow this up with a physics degree and you should be good to go. Research placements during your undergraduate summers are also great experience. The University of Sussex offers a course that allows you to spend time working in a research lab during the summer (if you get outstanding a-levels or equivalent qualification) which is unique to Sussex and a great opportunity to get involved in the field.

Is there a market for these quantum computing technologies and if so, what are the benefits of investing in such technology from a business point of view? I'm aware NASA owns their own quantum computer but what would that give them which their existing tech didn't? Furthermore, similar to the bitcoin mining industry, can you at all imagine a consumer 'renting' market whereby instead of physically owning a unit, the processing is done in house? P. S I'm from Sussex studying Physics at Exeter! Is it all possible I could drop by one day and take a look?

[erwinj](#)

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There's a whole bunch of different algorithms that have been proposed for a quantum computer. For instance, there are a whole subset that are related to optimisations (which is very important for example when looking at relations and trends in large data or best routes for delivery companies). You can also think about simulating chemical reactions or processes in biology, for example to help developing new medicines. So a quantum computer can do certain things that would otherwise take billions of years. NASA own a D wave processor which is special purpose quantum computer that may be able to tackle a some particular problems. What we are developing is a universal quantum computer, which can be used for the wide range of problems which a quantum computer promises the ability to solve. The first quantum computers will most likely be massive (think football fields) so it's probable that people will buy time on the quantum computer, much like people do with modern supercomputers. Certainly, do get in touch! You can find us through www.sussex.ac.uk/qt

What does this computer allow you to do now that you could not do before?

[mt1379](#)

Quantum computers allow to tackle certain problems even the fastest super computer may take billions of years to calculate. So don't think of a quantum computer as a very fast computer. It is a machine that allows to solve certain problems you would have never envisioned can be solved by a computer. The range of applications is vast ranging from optimisation problems to search and includes learning something about other physical systems. One might be able make better materials, understand processes in biology or even calculate the dynamics in molecules. But really since this technology is very new, it is very unlikely we yet know the most important applications.

What is the advantage or difference of this "large scale" quantum computer in respect to other quantum computers?

[nemoneo](#)

The largest universal quantum computers in the world have only a handful of qubits. A large scale quantum computer will have millions or even billions of qubits allowing to solve a very vast range of problems.

What is the most common misconception about practical quantum computing?

[Ingrassiat04](#)

I would say the largest misconception is that quantum computers are basically very fast computers. Quantum computers are really entirely different machines. In order to use quantum computers one also has to develop a new type of software, quantum software or as we call them quantum algorithms. This means quantum computer can only solve a problem if a quantum algorithm has been created for that particular problem. The development of quantum algorithms is currently in its infancy with only around 20-50 people worldwide working on making such algorithms. This corresponds to the state of developing algorithms for conventional computers in the 1940's. From that you can imagine that we are far away from knowing all the applications for a quantum computer.

I keep hearing everywhere that the rise of quantum computers may render [RSA](#) obsolete since it can implement [an algorithm](#) that can efficiently do integer factorization. Since much of the security of our current systems rely heavily on the difficulty of integer factorization, should we be concerned about the

coming of these technologies?

[lyonsames](#)

A large scale quantum computer of the sort we are developing at the University of Sussex will indeed be very good at factoring large numbers and it is therefore expected to be able to break RSA encoding. There are however very promising developments coming out of the post-quantum cryptography area which will provide protection. It is important to start thinking about using new encryption techniques now since some data is stored for decades.

Do quantum computers have any foreseeable place in the average home in the future? When computers we know were first made, the average person didn't know what to do with them, but that's changed. Will it be a similar deal with quantum computers, or are they really more catered to large scale calculations only?

[zabuu](#)

The first quantum computers will be extremely expensive and large. These machines will likely be used as cloud computing solution where you can log on to a quantum computer in order to solve a particular problem. I do not anticipate that quantum computers will replace conventional computers anytime soon. Instead they will be used to solve certain problems which cannot be solved by a conventional computer. As more and more quantum algorithms will be developed, more and more applications will emerge. At the beginning quantum computers will therefore be rarely used by a home user but this will likely change over time.

What kind of programming language could you use with this architecture?

[Barnowl79](#)

Operating a quantum computer is different from operating currently available computers. Specially written programs and compilers are therefore required which run the specially developed quantum algorithms on the architecture to perform the calculations.

When do you believe quantum computing will be available on a consumer level and why?

[420friendlee](#)

This will happen gradually. The first machines will be used for special applications. I would estimate the number of these applications to grow and with that the impact on consumers. Large scale quantum computers are still 10 to 15 years away. However, even small scale quantum computers may already solve certain problems conventional computers cannot solve. So in summary, this is hard to predict but likely at least 10 years away, possibly more.

What kind of 'new' jobs would a quantum computing would create?

[PogingPinoy](#)

Quantum computers will create a large range of new jobs. For example there will be a new types of engineers, quantum engineers, who will be skilled in the hardware side of quantum computing. There will also be a wide range of quantum software developers. In addition, quantum computers are expected to have a significant impact on a wider range of areas and with that have the potential to

create completely new industries with new types of jobs. It is important to note that we are only at the beginning of understanding how quantum computers may impact society and we will continue to unravel the opportunities this exciting technology will provide.