What is it?

How is it different?

How does it work?

Can you get one?

1. Moore’s Law — a law that tells us that computer power doubles about every 18 months.

2. computer chips are made of basic modules which are made of logic gates which are, in turn, a combination of transistors.

3. These simple little components are essential for all our electronics and the great news is, the smaller we make them, the faster they’ll be while consuming less energy. That’s why transistors now are approaching the size of a single atom

4. But once transistors reach a small enough scale, they’re prone to quantum tunneling. This means that when the transistors try to block the electrons from passing, those electrons could simply appear on the other side anyway.

5. This leads to a lot more errors and noise which leads to more error correcting which requires more powerful processors and so on. The idea behind quantum computers is to take these phenomena of the quantum realm and use it to our advantage to create better machines.

6. Instead of using bits, quantum computers use qubits. that can be in a state of 1, 0, or a combination of the two. In what’s known as superposition, qubits can be in between states. They could be said to be 30% 1 and 70% 0, for example. Qubits will only fall into a definite state if they’ve been observed.

7. One of the problems with our quantum computers now is that quantum e􀁩ects are

extremely delicate. Heat, noise, and dust can all cause qubits to change

their state of superposition so that they have to be shielded and run at

very cold temperatures, sometimes only a few degrees warmer than

absolute zero (–459.67°F). Researchers use resonators to see and read

the state of qubits since resonators are much easier to interact with.

8. Other phenomena these computers use is quantum entanglement and

Interference. It’s a connection between particles where

changing one will immediately change its counterpart, no matter how

big the distance between them. Interference is the ability to control

quantum states to promote signals headed towards the right answer

and cancel signals heading towards the wrong one, very similar to how

noise cancelling headphones use precise waves to cancel out incoming

noise waves, leaving only silence.

9. In terms of modeling processes in nature, like photosynthesis, our computers can’t

do that at all because nature encodes its information in quantum mechanics. It takes a quantum machine to model quantum events.

10. Other uses for these computers will be mapping the human brain, simulating chemical bonding, analyzing large amounts of data, spotting patterns, modeling climate change, making transportation

more efficient, and enabling progress in the field of artificial intelligence.

11. If a task required you to end one correct answer out of 100 million choices, an ordinary computer would go through 50 million steps to do so. A quantum computer would only go through 10,000. This is known as Grover’s algorithm and it’s an example of what quantum machines could do better.

12. Companies have also started taking security measures into question since quantum. computers could easily 􀁣y through the math underlying the encryption that secures our chats, social media, online stores, and banking.

13. It defends state secrets, and the corporate sort. It protects financial flows and medical records. And it makes the $2trn e-commerce industry possible. Without it, credit-card details, bank transfers, emails and the like would zip around the internet unprotected, for anyone so minded to see or steal.