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Encryption

Quantum technique could stop people faking their location

Karmela Padavic-Callaghan

CREATING a fully secure method to verify the location of a device or computer isn't possible with classical computers, but now it seems it will be with quantum ones.

Matthias Christandl at the University of Copenhagen in Denmark and his colleagues have developed a system for verifying location that takes advantage of special properties of the basic units of memory in quantum computers, known as quantum bits, or qubits.

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The number of qubits a hacker would need in order to fool the new system

Suppose you wanted to verify the location of a device. With the new system, you would connect it to two quantum computers that would then exchange a combination of quantum and classical information. The data is transmitted in such a way that it would be impossible for a scammer to spoof or copy it without being detected. This is because information stored on a qubit can't be copied surreptitiously.

The team found that exchanging a single qubit and a million classical bits would be enough to make the system secure against anyone with a quantum computer smaller than a million qubits. In other words, tricking the system would require a quantum computer thousands of times larger than any that currently exist (*Nature Physics*, doi.org/hr58).

Adrian Kent at the University of Cambridge says the new protocol should be simple to implement on existing quantum computers. And Gilles Brassard at the University of Montreal in Canada says the work is the most exciting result in the field in a decade.

Christandl says he aims to tweak and simplify the approach until it could run on a device no bigger than a credit card chip. ▮

Space

Meteorites on Mars may harbour signs of life there

Jonathan O'Callaghan

EVIDENCE of ancient life on Mars could be lurking in meteorites on the surface of the planet – and such rocks could be investigated by current and future rovers on the Red Planet.

Meteorites that fall on Earth are known to experience rapid contamination by microbes. These can leave telltale markers of their presence behind.

For instance, some may burrow into the meteorite and create microscopic tunnels. Others might subtly change the chemical composition of the rock. But it was unclear how well meteorites might preserve this evidence.

To address this, Alastair Tait at Monash University in Australia and his colleagues analysed seven meteorites they found on the Nullarbor plain in southern Australia, some of which landed up to 40,000 years ago.

They found that all of them contained evidence of fossilised microorganisms, as well as chemical changes wrought by the microbes (*Astrobiology*, doi.org/hr4g).

About 3 billion years ago, Mars may have had the necessary conditions for life, including a thicker atmosphere and liquid water on its surface.

Tait says that any meteorites that fell on Mars before or during this period, in a habitable location, could have been contaminated by Martian life in the same way that meteorites falling to Earth become contaminated by terrestrial life. "They would have essentially been a time capsule," he says.

Áine O'Brien, who is at the University of Glasgow, UK, says that meteorites on Mars were already known to offer a "really good" record of the geologic history of the planet.

"They are pristine when they arrive and distinct from the Martian surface," she says, so they could feasibly contain a record of past habitability. "If there was life, you would expect to see evidence of that."

However, meteorites that have been sitting on the surface of Mars for billions of years will have been bombarded by radiation, and this may have erased any such evidence, she says.

Dozens of meteorites have been found on Mars by various rovers. Tait says such rocks could be prime targets to look for signs of ancient life, both by NASA's Perseverance rover that is currently on Mars and collecting samples to return to Earth, and ESA's upcoming ExoMars rover, which has been delayed by Russia's invasion of Ukraine.

Tanja Bosak from the Massachusetts Institute of Technology, part of a team selecting samples for Perseverance to collect for possible return to Earth, says there are no plans for the rover to gather meteorites yet.

"Meteorites that fell on Mars when it was habitable could carry signs of Martian life"

"It's hard to recognise a rock as a meteorite," she says. "We don't have the time to stop and examine all random rocks."

Sara Motaghian at Imperial College London, however, is developing analytical tools for ExoMars's cameras to quickly identify meteorites on Mars. She says the same tools could be used by Perseverance.

"We can study them with the drill or by crushing them with the wheels," she says, noting that the interiors of some meteorites on Mars could even provide shielding from radiation and be "tiny habitats" for life that may be there now.

Even if the rovers don't directly sample meteorites, Tait says that some samples returned by Perseverance could contain meteoritic material mixed into the Martian soil. ▮

A meteorite on Mars photographed by NASA's Curiosity rover

NASA/JPL-CALTECH/MSSS