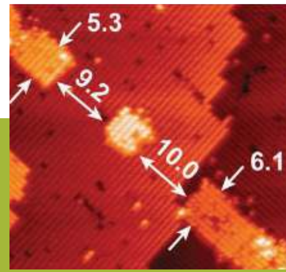
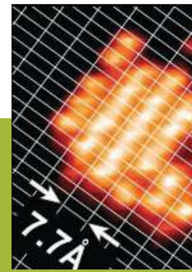
Protecting phones, robots and governments—partners in cybersecurity

Your smartphone's Wi-Fi connections are fast and reliable thanks to the work of Australian astronomers in the 1990s

Boeing's unmanned Little Bird withstood cyberattacks thanks to Australian kernel software.

Australian and US researchers are collaborating to create quantum computers and the software they'll need to do useful work.





Today, your phone is also being protected from cyberattacks by Australian software that works within the kernel of the phone's operating system to protect it from hacking and software faults. The kernel is the most fundamental part of an operating system. It acts between the hardware and the applications.

Now Australian researchers are working to secure America's growing fleets of autonomous machines, with 'microkernel' software known as seL4.

The new software is built on the work of researchers at the University of New South Wales and National ICT Australia (now CSIRO's Data61 Group). They developed a microkernel known as OKL4 which was adopted by Qualcomm for their cell phone chips, and then by Apple to run and protect the security processors used in all recent iPhones and iPads.

Then the Australian team went back to basics and invented seL4, an entirely new microkernel that delivers unprecedented security guarantees through mathematical proofs.

In a recent trial, Boeing's unmanned Little Bird Helicopter was protected from cyberattacks by the software, which is also being used on autonomous US Army trucks being developed with the support of the DARPA High-Assurance Cyber Military Systems program. The team invited to hack into Little Bird accessed non-critical systems, but failed to take control of the helicopter because seL4 protected the essential control systems.

The genius of seL4 lies in its proved isolation between software compartments. Dr June Andronick from CSIRO's Data61 group explains, "If your software runs the seL4 kernel, you have a guarantee that if a fault happens in one part of the system it cannot propagate to the rest of the system, in particular the critical parts."

The future is quantum

Quantum computing has long been a focus of cybersecurity. Quantum computers could theoretically smash the encryption technologies used today by business and government.

A Sydney-based team are currently favourite to win the race to create a quantum computer based on silicon technologies. The University of New South Wales team have already developed key components of a computer and have secured the support of a major Australian bank and telco. They also have strong support from Australian and US government agencies. Because they are working in silicon they expect their systems will be relatively easy to manufacture.

Across the city is Microsoft's Station Q Sydney, one of eight sites worldwide where Microsoft is focussing its billion dollar-plus investment in quantum computing. It's hosted at The University of Sydney and is led by Professor David Reilly. Next door to David is Professor Michael Biercuk, working on quantum simulation, also with substantial US support.

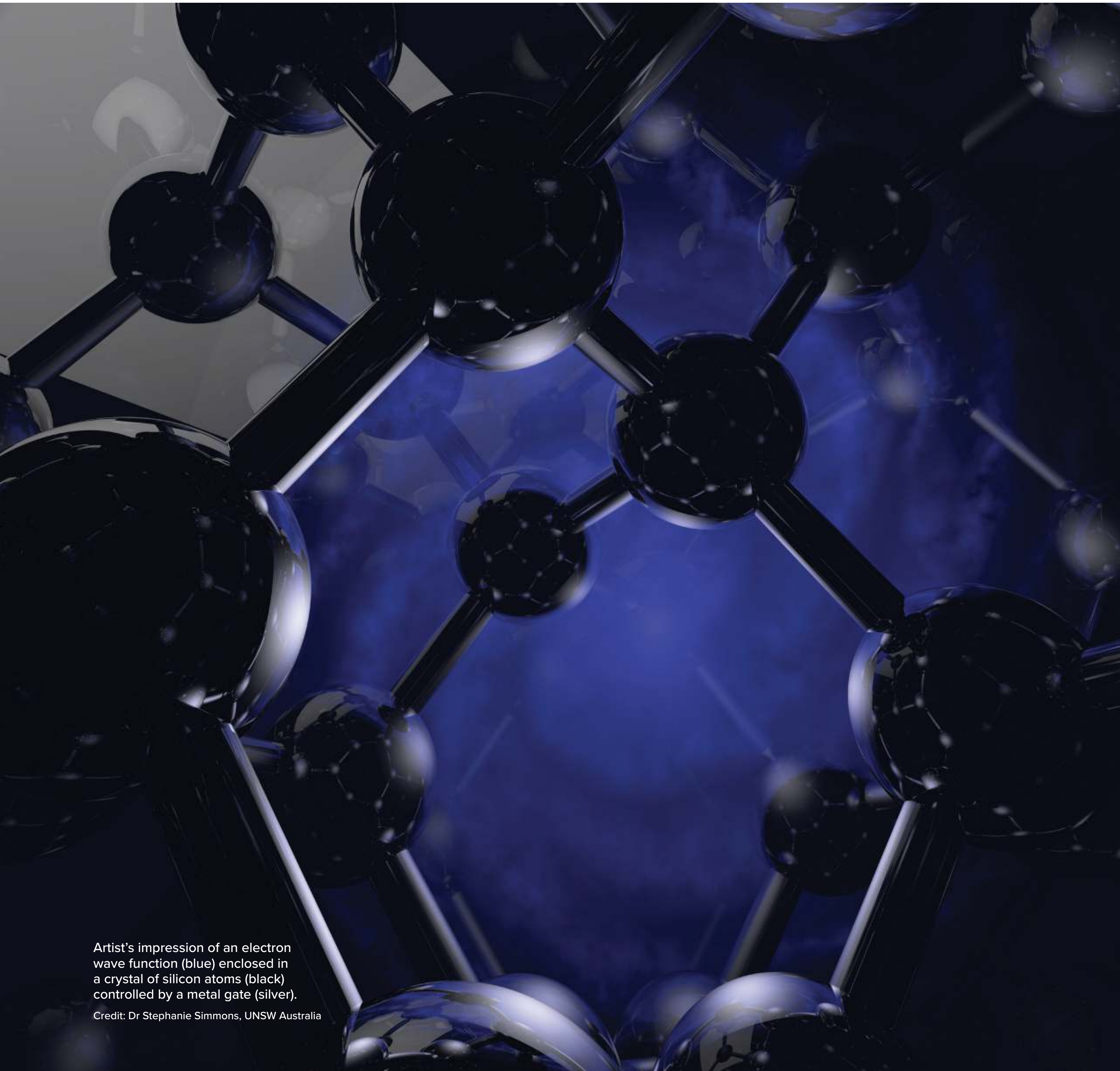
Quantum computers will need software. Q^xBranch are on the case. This Washington DC-based business grew out of a collaboration with Lockheed Martin and is working with banks and industry in both Australia and the US on developing the software quantum computers will require before they can do useful work. In March 2017 Q^xBranch announced that they'd developed a quantum computer simulator. Michael Brett, chief executive of Q^xBranch, says the idea is that "some Tuesday morning when a quantum computer becomes available we just swap out our simulation for the real hardware".

Protecting us from the code-cracking power of quantum computers will be the task of QuintessenceLabs. They are harnessing the quantum properties of lasers to deliver quantum security solutions that will robustly enable the protection of data no matter where it lives. Based in Canberra and San Jose, their products are founded on the Australian National University's leadership in quantum phenomena and have already attracted interest from IBM and Northrop Grumman.

Read about these, and other Australia-US partnerships in energy, food, mining, biomedicine, advanced manufacturing, and more at www.usa.embassy.gov.au

Australian Government

Quantum computing: Australian researchers are working closely with their US colleagues to turn what was once science fiction into reality.



Artist's impression of an electron wave function (blue) enclosed in a crystal of silicon atoms (black) controlled by a metal gate (silver).

Credit: Dr Stephanie Simmons, UNSW Australia