EDUCATION

School

MAKE THEM ACCOUNTABLE
Lex Lasry QC and David Marr will address political accountability at the Melbourne Conversations and Future Leaders forum. BMW Edge, Federation Square, June 27, 6-7.30pm. Free. rsvp@futureleaders.com.au

BLOG ONTO THIS
John Lenarcic will contemplate the impact of blogs on popular culture in the next University In the Pub event. The Stork Hotel, 504 Elizabeth Street, Melbourne, tomorrow, 7pm. Free. Inquiries: 9663 6237.

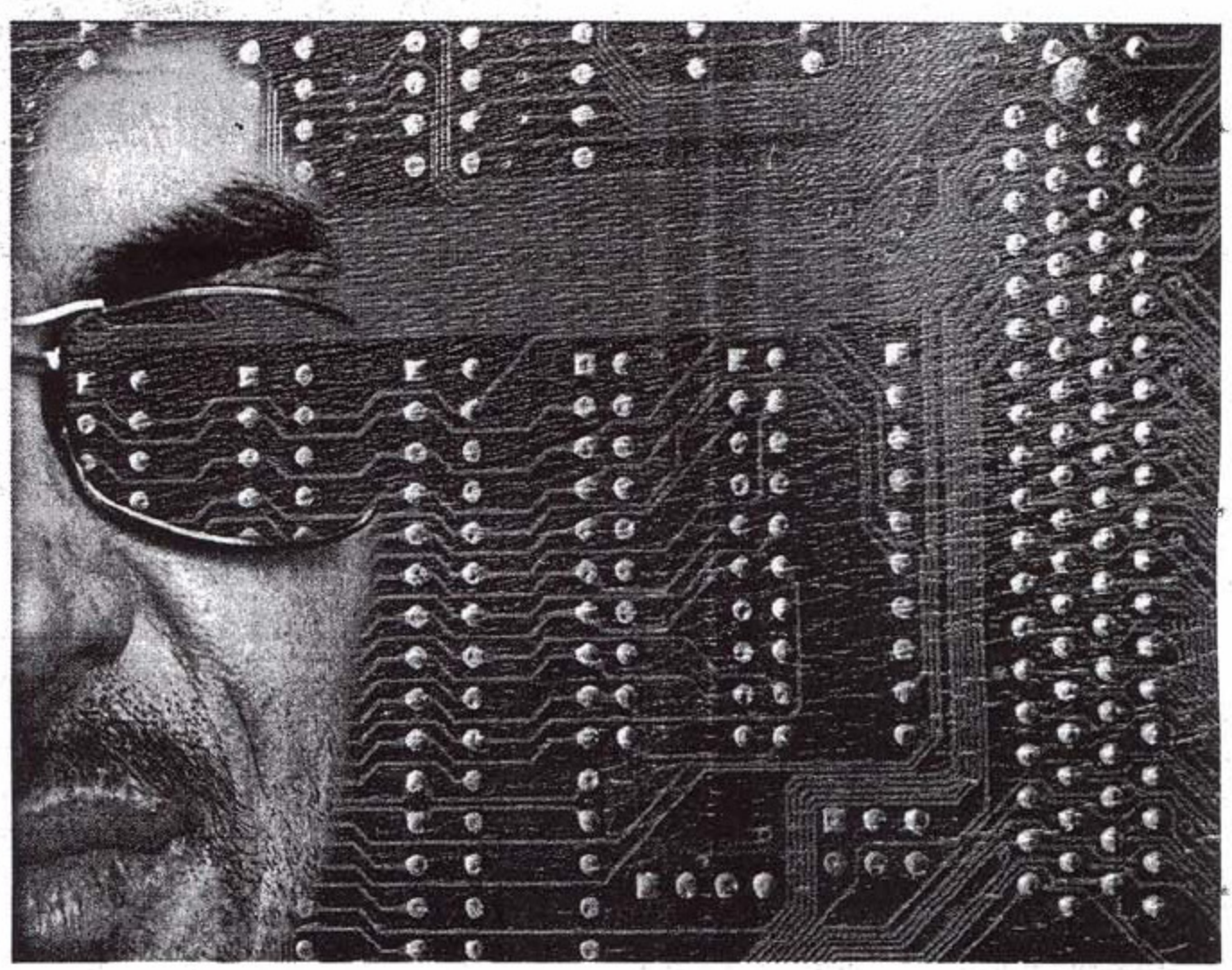
A LOOK AT THE FUTURE
The Future Melbourne series will continue with a public forum on sustaining Melbourne's prosperity. Bio21 Institute, 30 Flemington Road, Wednesday, 6-7.30pm. Registration: futuremelbourne.com.au

Email events to: jgrumont@theage.com.au

ASIAN FOCUS
Trade and investment expert Dr Richard Feinberg will focus on APEC and the rise of the Asian economies. Sidney Myer Asia Centre, June 26, 12.30-1.30pm. Inquiries: 8344 8474 or www.asialink.unimelb.edu.au

Dangling carats to catch a thief

Researchers at Melbourne University have invented a device that relies on quantum physics to defeat criminal hackers, writes **Geoff Maslen**.



FORTUNATELY for *The Age*, Shane Huntington has interviewed more than 500 scientists on 3RRR's science radio program over the past 12 years. He has had plenty of practice lucidly explaining hundreds of scientific concepts to a general audience. Which is why, when he is interviewed, he makes his research into the mysterious micro-world of quantum mechanics seem easy to understand.

Well, sort of. After all, quantum mechanics is involved with almost infinitesimally small objects that don't obey the laws of normal physics, as well as with strange notions such as that light actually consists of tiny packets of energy called photons.

And it is the photon that is the key to a unique device Dr Huntington and his research team have invented to stop hackers from intercepting top-secret information being communicated between governments, security agencies, financial institutions or individuals.

Dr Huntington is chief executive of Quantum Communications Victoria, a $9 million joint venture company established within Melbourne University's school of physics. The instrument the researchers have developed relies on the peculiar properties of a photon that were first enunciated 80 years ago by a German physicist, Werner Heisenberg.

Now known as the Heisenberg Uncertainty Principle, it states that merely observing a particle as small as a photon alters it: once you look at it, it's never the same again. This is the basis of Melbourne's anti-hacker instrument which uses the properties of diamond to send single photons, one at a time, along an optical fibre cable.

The instrument the researchers have developed relies on the peculiar properties of a photon . . .

Dr Huntington says a diamond is the only material capable of delivering single photons reliably at room-temperature over a prolonged period. But this requires that a diamond crystal first be grown directly on to the tips of optical fibres, atom by atom in a microwave-generated plasma. (Curiously, it is not the diamond itself but an imperfection that emits the light as one photon at a time — a foreign atom that is placed within the diamond lattice while it is being grown on the optical fibre tip.)

The size of the diamond is a tiny fraction the size of a human hair; a hair is 50,000-80,000 nanometres wide, while a diamond on the tip of the fibre can be 10-1000 nanometres, depending on what is required.

"When we send messages normally along an optical fibre cable it involves millions of photons every time we send a signal," Dr Huntington says. "So, if someone intercepted the signal we would never know and, even if the message were encrypted, the hackers could store the data and analyse it at a later date, possibly far in the future."

He says commercial devices are freely available that enable light to be extracted from optical fibres without breaking them or alerting the sender and receiver to the theft.

"This isn't your traditional hacker invading your computer at home," he says. "It's more someone who latches on to a cable that could be out in the desert and extracts information to analyse later."

Banks transmit data to outside storage facilities and Dr Huntington says that if hackers extracted that information they might be able to obtain the bank codes and details of people's accounts — information the banks and their customers want to keep private. "I've seen FBI reports indicating that this is a big problem worldwide," he says.

One of the joint partners with Dr Huntington's company is a Boston-based firm called MagiQ, the first American start up firm devoted entirely to quantum computing.

Dr Huntington says that although MagiQ has developed instruments using quantum encryption to send information securely, it did not have a device that could send one photon at a time so it was natural the two companies should join forces.

"The materials research group in the school of physics here has a long-standing program looking at diamond in terms of its ability to unleash individual photons in a controlled way. The unique part we brought to the project was to integrate that knowledge with communication technology."

The key to the diamond device is that while millions of photons flow down the optical fibre cable every second, only one arrives at a time — there are never two together. That is important, Dr Huntington says, because if two or more arrived, one could be stolen and the receiver would never know.

Dr Shane Huntington leads way with a hacker alert device. PICTURE: RODGER CUMMINS

According to Heisenberg's uncertainty principle, however, if anything happened to the single photon travelling along the cable, the end user would know and be able to take action.

"The analogy is with a person's home; we can't prevent burglars breaking into our homes but we can ensure we are alerted to the fact. That is what this is about — being absolutely sure that if the message is sent successfully, no one has stolen it."

A working version of the diamond-based instrument has been demonstrated in the laboratory and the device is being improved to make it robust and able to be integrated into existing telecommunication systems.

"We are looking at having a prototype ready in another 18 months," Dr Huntington says. "While the device works on a lab bench, it needs to be able to sit in the back of a Telstra truck, handle changes in environmental conditions, be robust enough to be moved from place to place and put inside some other system, just as a laser diode in a DVD player is a component of a larger machine."

Dr Huntington and his team will arrange visits to schools to discuss quantum physics and will also organise school visits to the university. Go to: qcvictoria.com/education—portal/school—visits