Rare material key to computer advances

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Researchers from Victoria University of Wellington have answered fundamental questions about a rare class of materials that could lead to faster, more reliable memory storage in computers.

Dr Ben Ruck, Professor Joe Trodahl and Dr Franck Natali from the School of Chemical and Physical Sciences, have spent several years understanding the properties of rare-earth nitrides (RENs), thin films grown under ultra-high vacuum which are both magnetic and semiconducting.

The team is one of only a few worldwide exploring commercial applications of RENs, with two concepts already patented. They include developing the first magnetic memory storage devices based on RENs, called magnetic tunnel junctions.

A computer has two types of memory, a hard disk drive coated with magnetic material, and random-access memory (RAM) that stores data electrically, explains Dr Ruck. The issue with RAM is that it does not retain information when the host computer turns off.

"What we're working on is a magnetic type of RAM that doesn't disappear. Because data is retained when the power is switched off, a device can perform faster, be more versatile and use less energy. This is ideal, as an example, for cloud data storage spanning across multiple servers," says Dr Ruck.

In collaboration with a team of researchers in France, based at the Centre for Research on Hetero-Epitaxy and Applications, which has facilities to grow pure versions of RENs, Dr Ruck and his colleagues are also in the process of testing a new way to control how RENs use electricity.

"No one has made a magnetic semi-conductor where you can truly control the electrical conductivity. Our results provide a new way to control conduction precisely, meaning you can swap a device from being magnetic to non-magnetic, surpassing existing electronics regarding speed and power consumption."

This is a significant breakthrough for developing and constructing spintronics devices, an emerging technology where the spin of an electron is controlled to manipulate its charge.