

Edited by Archana Sharma

Scientists produce single-molecule transistor

Imagine a computer crash that does not result in any loss of data – that is what the new “spintronic” transistor promises.

Researchers at the Institute of Microstructural Science in Ottawa, Canada, have built a new transistor based on the fundamental property of spin for controlling and switching electrical current.

Normal electronics and microelectronics are based on just the number of electrons; transistors are based on devices that switch

states when current passes through them or not. The new spintronic transistor, however, is made from a quantum dot (*CERN Courier* January/February p9), which holds the electrons just like atoms. Electrons may be added one by one with a defined spin state – up or down – which in turn defines whether or not electrical current can pass through the quantum dot. A magnetic field is used to tune the quantum dot so that the spins of the electrons can be aligned. This is the “gate mechanism”,

which can turn the dot “on” or “off”.

Despite being a big challenge, researchers have been able to maintain flowing currents through spintronic devices, which has raised hopes that they could replace bulkier electronics in the future. No practical circuit has yet been operational, but promises of quantum computers that could boost the capacity and power of information technology many times over are in the offing. *Nature Science News*

Portable X-ray diagnostics now operational

In a revolutionary miniaturization of the conventional X-ray tube, physicists from the University of North Carolina have invented a cheap and portable means for biomedical imaging. Current X-ray tubes have cathodes that operate at temperatures of 1000–1500 °C, giving off X-rays from the heated filament. The new instrument uses the same concept – high-energy electrons strike a piece of metal, stimulating its atoms to emit X-rays. In this device, however, the emission occurs at room temperature and consumes much less power than traditional cumbersome X-ray machines.

A carpet of tiny filaments – carbon nanotubes, each a few millionths of a millimetre



These pictures of a hand and a fish were taken with a carbon-nanotube X-ray source.

across – is laid on a disc. When the disc is negatively charged, a positively charged mesh placed just above it can extract electrons from the tips of the nanotubes. These strike a positively charged copper plate a few millimetres

from the mesh, which then emits X-rays. The device can be miniaturized to a small volume, and is capable of providing high-resolution images. Its tightly focused beam also removes the risk of damaging the surrounding tissue. The device could also be used to produce ultrahigh-resolution X-ray images that would be useful in materials sciences as well as in medicine. The researchers have operated their device continuously for more than 10 hours without any signs of degradation.

Reference

Yue *et al.* 2002 *Appl. Physics Letters* **81** 355–357.

Researchers find evidence of double proton radioactive decay

Stable atomic nuclei are characterized by the number of protons and neutrons that they contain. This equilibrium is perturbed by an excess of either protons or neutrons, leading the nucleus to become unstable and disinte-

grate, usually via beta decay.

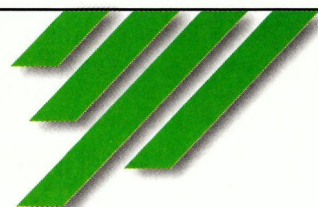
Now, for the first time, researchers from the French GANIL and German GSI laboratories have found evidence of the radioactive disintegration of iron-45 by the simultaneous

emission of two protons. This mode of decay has been sought after for 40 years, and its discovery will open up new avenues in the study of the structure of atomic nuclei. *CNRS/GSI*



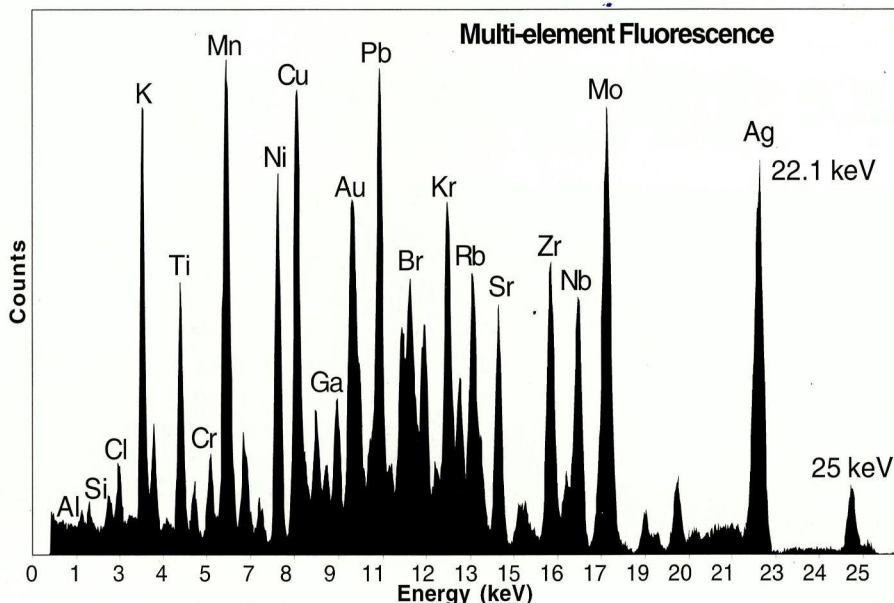
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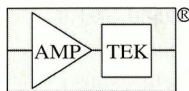
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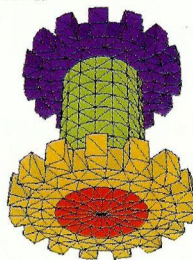


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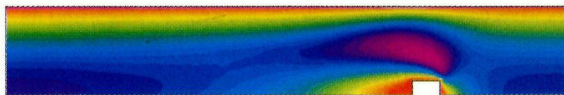
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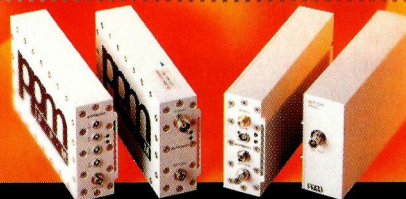
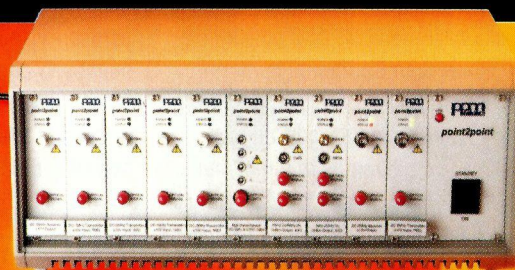


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