Cold fusion

Honest!

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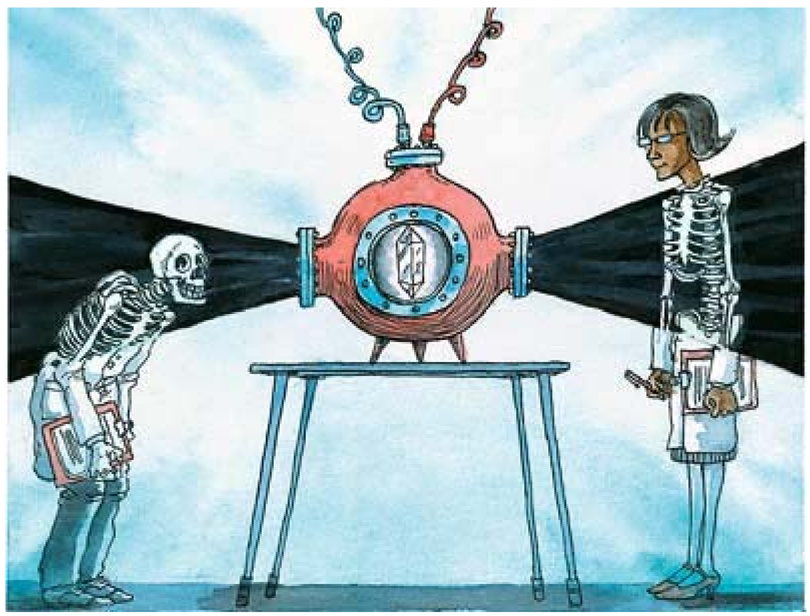

A report of a desktop experiment that produces nuclear fusion is bou raise eyebrows. But this time, the results look convincing

PHYSICISTS who meddle with cold fusion, like psychologists who dabble in tl paranormal, are likely to be labelled quacks by their peers. This is due to an incident in 1989 when Stanley Pons and Martin Fleischmann held a press con announce their discovery of nuclear fusion in what amounted to a test-tube f water connected to a battery. In particular, they said that they were getting energy out of the process than they put into it. Their result was instantly dub fusion", to contrast it with giant fusion-reactor experiments that attempt to r the ultra-high temperatures found inside the sun. But when it failed to stand scrutiny, confusion—and eventually outrage—ensued.

In 2002, history repeated itself as farce with the announcement by a group a Ridge National Laboratory in Tennessee of fusion inside the bubbles that are by ultrasonic waves travelling through a liquid. This result passed the peer-re process, but was immediately attacked by another group—from the same lab which claimed to find no such effect. There was a counterclaim by yet a third year, and a final verdict on "bubble fusion" is still not in. But most people ha

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interest in the debate, assuming that anyone claiming to have observed fusic desktop experiment is a crank or a fraud. This attitude, however, may yet tu be mistaken. Desk-top fusion may be possible after all, according to an articl published in this week's *Nature* by three researchers at the University of Cali Angeles (UCLA).

Brian Naranjo, Jim Gimzewski and Seth Putterman have been meticulous in their experiment, and in particular in their measurement of one of the tell-tales of nuclear fusion, the production of neutrons. Their results have been peer-reviewed, and they make no wild claims of surplus energy being produced. Given past excesses, such caution is understandable. And it may indeed be the case that their technique, which involves banging together the nuclei of deuterium atoms (a heavy form of hydrogen) using a tiny crystal in a palm-sized vacuum chamber, will never provide a source of power. It could have some interesting applications, nonetheless.

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Energy from crystals

In principle, nuclear fusion is a simple process. All you have to do is push two suitable atomic nuclei close enough together for them to overcome their mutual electrical repulsion (since both are positively charged) and they will merge. This merger releases oodles of energy. The usual way to push nuclei together is to smash them into one another at high speed. In thermonuclear fusion (the sort that happens in the sun, in hydrogen bombs, and in traditional fusion experi that speed is achieved by heating the atoms up. But this, as Dr Naranjo and colleagues realised, is not the only way to do things. You can, as they have c simply accelerate a stream of nuclei to high velocity, and fire them into a sta target.

Traditional accelerators, such as those used in particle-physics experiments, voltage electricity to achieve this acceleration. However, they are cumberson they consume a lot of power while doing so. Dr Naranjo, by contrast, has de compact way of generating high voltages at much lower power using a so-ca pyroelectric crystal.

Heating such a crystal (or, rather, warming it from -30°C to just above freez deforms its structure in a way that concentrates positive charge in one place negative charge in another. That results in a big voltage between the two. Th researchers then amplified the effect of the positive charge by attaching a m the place where it was accumulating. This concentrated the electrical field in way that the point of a lightning conductor concentrates the stroke.

Dr Naranjo used this effect two ways: first to strip deuterium atoms of their
and second to repel the resulting stream of deuterium nuclei at high speed t
target containing more deuterium. When two deuterium nuclei (each compos
proton and a neutron) fuse, the result is a type of helium composed of two p
a neutron, a free neutron, and a lot of energy. The bombardment also produ
X-rays. By counting the neutrons and measuring the X-rays the researchers
that about 1,000 pairs of deuterium nuclei were fusing every second.

This is, as they are the first to admit, a long way from producing a significan
of energy. And although they reckon they could boost the fusion rate 1,000-
better apparatus, that still might not reach the magic threshold of producing
energy than it takes to run the experiment. Beyond that, they are understan
unwilling to speculate.

This does not, however, mean that their device will have no applications. Wit
little tweaking it could be turned into a handheld X-ray scanner, which would
significant medical advance. Not yet a precursor to a starship engine, perhap
maybe an ancestor of Dr McCoy's portable diagnosis machine.