

# This week

## Physics reels as the financial axe falls

Some of the hottest projects in science have been thrown into confusion. How will they cope?

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DO OTHER planets like Earth exist? Is there a theory of everything? Could fusion provide cheap and unlimited energy? Physicists think they know how to find the answers to all of these questions. Yet late last month their ability to do so suffered a series of devastating blows.

In December, two major funding announcements gave physicists on both sides of the Atlantic an unpleasant – and unexpected – Christmas present. In the US, Congress cut \$94 million from particle physics and fusion programmes just months after politicians had agreed on substantial increases. In the UK, the country's main funder of big physics – the Science and Technology Facilities Council (STFC) – pulled out of several international astronomy and particle physics projects, and cut the money it gives for university grants by a quarter. This sudden reverse comes after several years in which government funding for UK science has been steadily rising.

The cuts are being felt right across the field, and questions are being asked about why they happened (See "Coincidence or conspiracy?"). Many branches of physics are being plunged into crisis as projects are shut down, grants are rationed and international commitments are broken without warning.

According to many senior researchers, the spending shortfall is the worst of their careers. "These are savage cuts," says Michael Rowan-Robinson of Imperial College London, president of the

UK's Royal Astronomical Society. "We've never experienced anything like this."

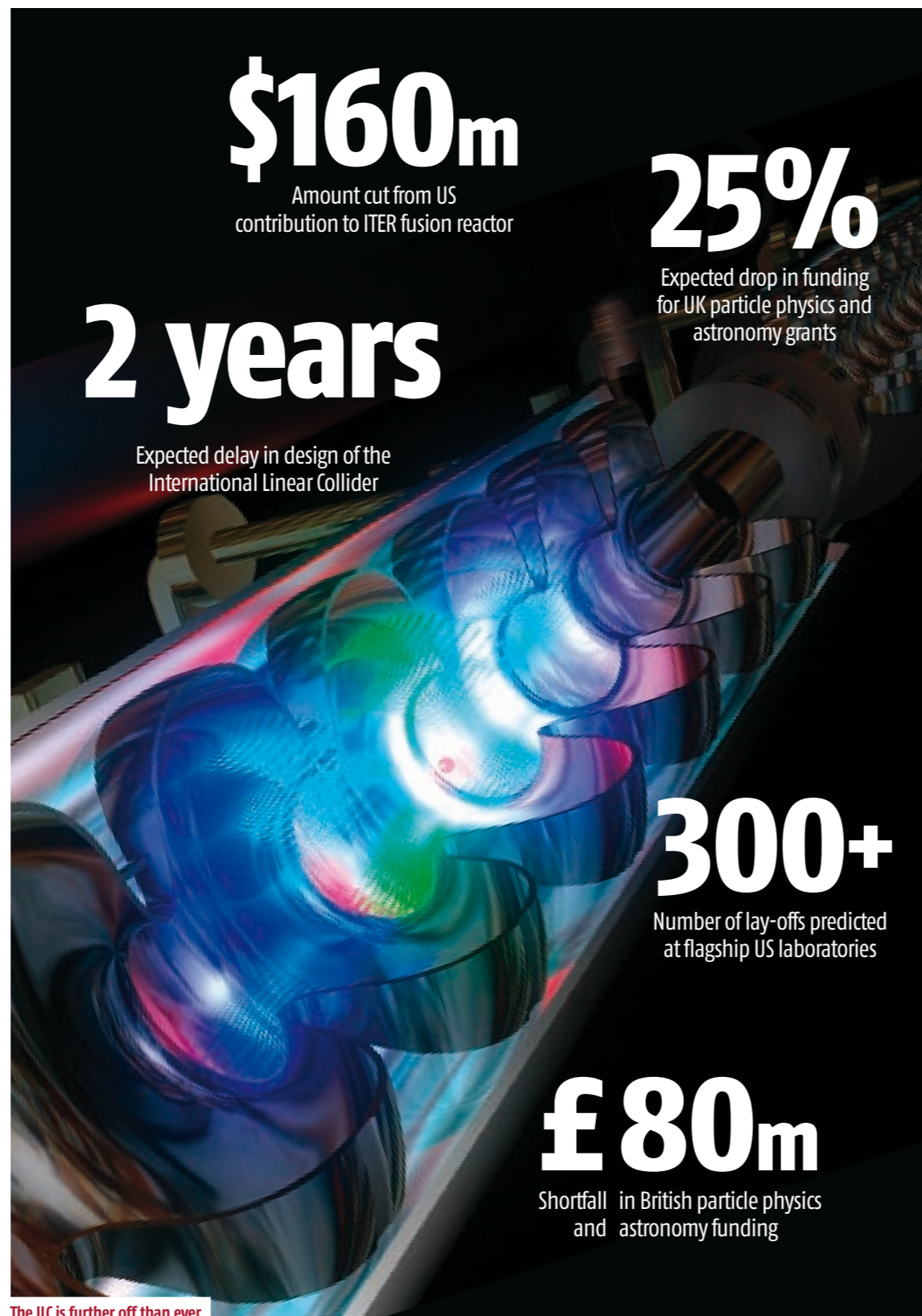
The International Linear Collider (ILC) took the hardest hit. The plan for this \$7 billion project is to smash beams of electrons into positrons, their antimatter equivalent. Hidden in the debris would be a zoo of exotic particles which physicists would be able to examine in much greater detail than will be possible with the Large Hadron Collider, which is almost ready to fire up at CERN, the European particle physics centre near Geneva, Switzerland.

Last month, the UK announced that it was pulling out of the ILC altogether. It had been spending around \$8 million a year and has around 55 people working on the project.

An even heavier financial blow came a day later, when the US Congress cut its ILC contribution for the financial year – around \$60 million – by 75 per cent. Since the other 25 per cent has already been spent, work on the design

**"The pay-off from the ITER fusion reactor could be immense, but the planned completion date may have to be pushed back"**

by the US has now ceased. The decision is part of the reason why the two main centres working on the project – Fermilab in Batavia, Illinois, and the Stanford Linear Accelerator Center in California – predict that they will have to lay off more than 300 staff. "This makes for an immediate crisis," says Barry Barish, head of the collider's global design team. "All of a sudden there are missing people



everywhere." He estimates that plans to complete the design by 2010 will be delayed by two years.

Barish is not the only project leader digesting bad news. Kaname Ikeda spent the holiday break thinking about how to cope with the US decision to cut its expected \$160 million contribution from ITER, the \$10 billion fusion reactor project that he heads. The pay-off from ITER could be immense. If the reactor succeeds in harnessing the energy created by fusing isotopes of hydrogen, it could pave the way for commercial fusion power plants that emit no greenhouse gases and run on cheap and abundant fuel. A site for the reactor is currently being levelled at Cadarache, France. The impact of the cuts is not yet known, but the planned 2016 completion date may have to be pushed back, since the US contribution amounted to 10 per cent of the total budget.

The ILC and ITER were relatively easy targets for politicians since they are both under development and being built abroad. But more mature domestic projects have also suffered. For example, the NoVA experiment at Fermilab, designed to probe the nature of a suite of ghostly particles known as neutrinos, lost its \$36 million funding for the current year.

Fermilab had been in the middle of upgrading its particle accelerator, with the aim of firing a beam of neutrinos 800 kilometres through the earth to a detector in Minnesota. By tracking whether the neutrinos switch between identities en route, physicists would be able to tighten up their estimates of the particles' masses. Those would be critical results, says Boris Kayser, a theoretical physicist at Fermilab. There are several theories vying to unify the universe's particles and forces, and each makes different predictions about neutrino masses, so NoVA would help narrow the field.

In the UK, the STFC signalled an end to British involvement in several major astronomy projects, possibly including the

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### COINCIDENCE OR CONSPIRACY?

Why did two major science powers decide to slash funding for physics at the same time? While some have begun to worry that research is falling out of favour, the consensus is that it probably has more to do with political expediency and poor management than a concerted attack.

In the US, Congress had been fighting the administration for months over how a flat total budget should be shared out. Both sides initially agreed that physics should get substantial increases, but time ran out on the negotiations and something had to give. Policy observers say it was easier to cut US involvement with overseas science projects than risk a backlash by targeting domestic priorities such as healthcare.

Tough as this is, there could be even bigger problems ahead for US physics. Kei Koizumi, a policy expert at the American Association for the Advancement of Science, points out that just a few months ago the Democrats and Republicans had agreed on the need to double US physics spending. "If these cuts can happen in an atmosphere where both parties agree on doubling, imagine what could happen if people stop talking about it," he says. (see also "Commentary", page 48)

Physicists in the UK suffered for different reasons. The Science and Technology Facilities Council, the body behind the cuts, points to escalating running costs, and also argues that savings had to be made somewhere to meet its commitments to several big projects, such as the Diamond synchrotron being built at Harwell in Oxfordshire, and an international observatory in Chile.

Many scientists blame administrative failings rather than a policy change for the cuts. "It's an accounting cock-up and bad management. It could have been seen coming six months ago," says Peter Littlewood, head of physics at the University of Cambridge. He thinks those higher up the chain of command were probably not aware of the trouble the STFC had got itself into until the cuts were announced. "There is clearly something broken in the system, because I don't think the government believes that they were cutting the science budget." Next week, a parliamentary select committee will begin questioning STFC officials over their handling of the budget.

Gemini telescope in Hawaii. This instrument is powerful enough to spot planets orbiting stars in other solar systems and can image the most distant galaxies. A loss of access to the Hawaii telescope leaves British astronomers without access to anything of similar power in the northern hemisphere; in effect, the UK's optical astronomers can now only look at half of the sky, says Rowan-Robinson.

Researchers in British university departments are also waiting nervously to see if their funding will be pulled. "Nobody knows where all the cuts will come," says Peter Littlewood, head of physics at the University of Cambridge. "For universities, this is the most worrying thing. This money is critical."

The best that physicists can hope for now is that the shortfall will be short-term. British

researchers are hoping a government-commissioned review of UK physics, due to report in around six months, will conclude that the cuts should be reversed.

For US researchers, help could come in next year's budget, for which negotiations begin next month. Alternatively, Congress could, in theory, pass a bill that reverses the cuts in the last budget. Democratic presidential hopeful Barack Obama and other politicians representing Illinois, the home of Fermilab, have pledged to support such a move.

Kei Koizumi, a policy expert at the American Association for the Advancement of Science, thinks success this year is unlikely. "Most additional spending is for disaster relief or areas where funding is politically visible, for example veteran spending," he says. ● (See editorial comment, page 5)

