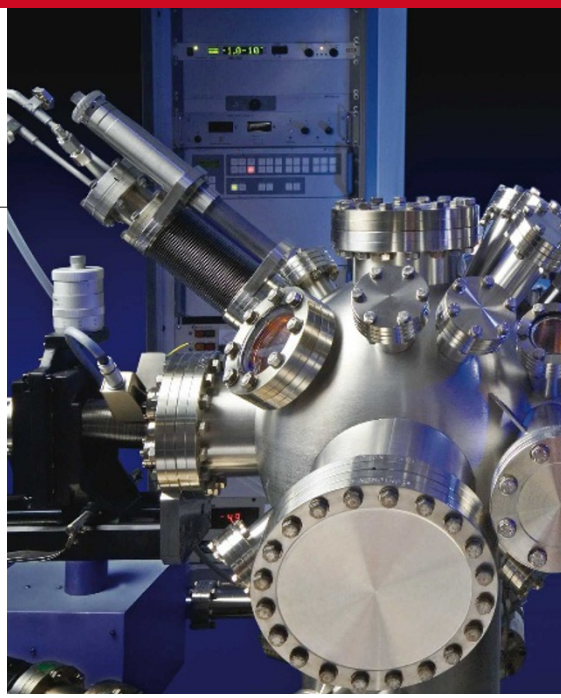
NEWS

£130-million cut to grants hits UK physical scientists



UK physicists, still reeling from massive funding cuts announced earlier this year, have learnt of worse to come. Roughly £130 million (US$260 million) is being slashed from research grants awarded by the Engineering and Physical Sciences Research Council (EPSRC), it announced on 17 March.

The EPSRC scale-back, which will mean grant cuts of up to 15% for investigator-led research areas and job losses, comes just months after the UK Science and Technology Facilities Council announced funding cuts of around £80 million and a 25% reduction in grant money (see *Nature* **451,** 386; 2008).

"This could be as big a problem as the £80 million cuts in the Science and Technology Facilities Council," says Philip Moriarty, a nanotechnologist at the University of Nottingham.

The EPSRC says its 'responsive-mode' grants will be affected by the cuts. These are grants for which proposals can be submitted on any topic related to engineering or physical sciences. The council says much of this money will instead be channelled into funding research in specific government-defined areas. But, overall, the amount of research funded by the council will drop by between 3% and 5%, it says.

Physicists, chemists, engineers and other researchers whose work does not fit into the six government-defined themes of nanoscience, health, IT, security, environmental change and energy will have to fight hard for the remaining responsive-mode money. Even before these cuts, fewer than one-third of research-grant proposals submitted to the EPSRC were successful last year.

"The 12% to 15% cut to investigator-driven research, coupled with the EPSRC's knowledge-transfer strategy, means that truly innovative science is less likely to result from EPSRC funding," says Moriarty. "Work on fundamental quantum mechanics, of the type that won Tony Leggett the Nobel Prize in Physics in 2003, would struggle for funding in the current EPSRC system."

Peter Main, director of science and education at the UK Institute of Physics, says there is real concern about a shift from curiosity-driven research to applied programmes. "The real danger is that if you're not careful you end up funding lower-quality research simply because it is related to a particular topic," he says.

The EPSRC was given a budget increase of 18.6% by the government last year, but the extra money has been eaten up by inflation and its commitment to paying the full costs of research, which include maintaining equipment and building infrastructure. Rather than

String theorists hope to classify the cosmos

Physicists' search for a theory of everything is entering territory more familiar to biologists: taxonomy. A small team of theorists is meeting in Tucson, Arizona, in April to discuss how to classify the billions upon billions of different possible universes created by string theory, which describes fundamental particles and forces as vibrating strings.

"String theory is notorious for having a lot of solutions," says Keith Dienes, a physicist at the University of Arizona in Tucson. "We are having this big kick-off meeting to try and organize ourselves," he says. The String Vacuum Project aims to begin placing the various solutions into broad categories. If it works, then theorists may finally begin honing down the version of the theory that best fits with the cosmos.

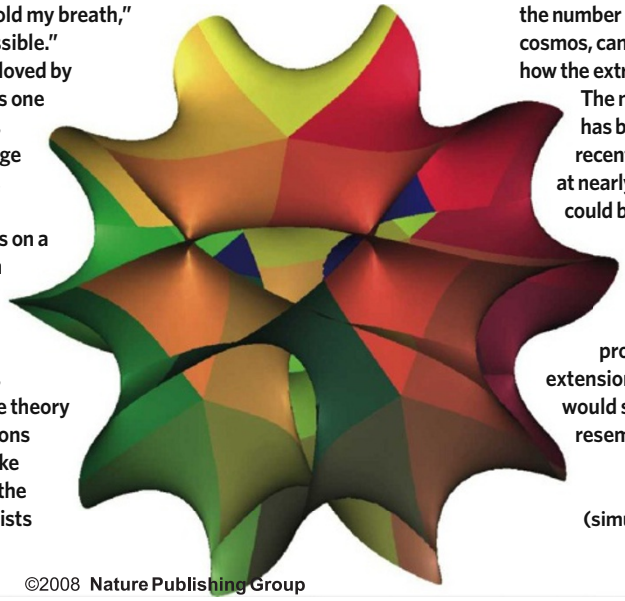
But that's a pretty big if. There's no guarantee that the different possibilities will be easy to classify, or that the solution matching our Universe will be easy to find, according to Nathan Seiberg, a string theorist at the Institute for Advanced Study in Princeton, New Jersey. "I wouldn't hold my breath," he says, "but it is possible."

String theory is beloved by theorists because it is one of the few paradigms that promises to merge quantum mechanics, which explains the behaviour of particles on a subatomic level, with general relativity, which describes how gravity shapes large entities such as galaxies. To do so, the theory uses 10 or 11 dimensions of space-time. To make the theory resemble the physical world, theorists get rid of the extra dimensions by folding them up.

Like a sheet of paper, there are a nearly infinite number of ways to fold the extra dimensions, and each leads to a different 'vacuum' or fundamental state of the Universe. Some vacua have four forces, like ours, whereas others might have six or eight or ten. The strengths of those forces, the masses and number of fundamental particles, and even the number of dimension in a given cosmos, can all vary according to how the extra dimensions are folded.

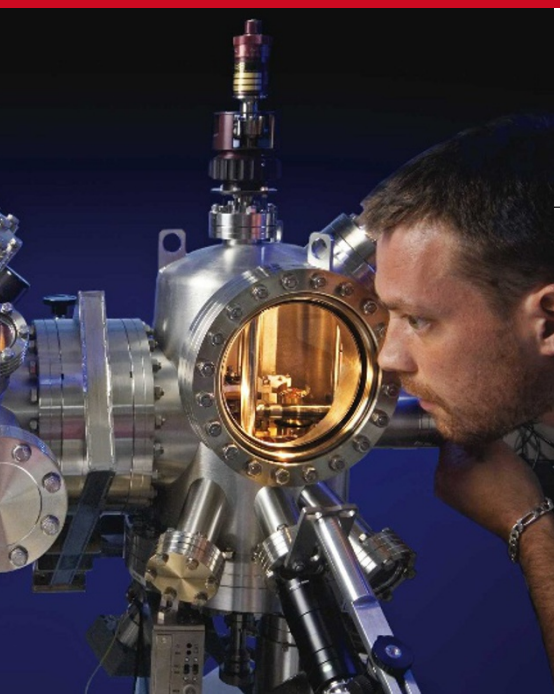
The number of possibilities has been steadily rising in recent years and current sits at nearly 10^{500}, although there could be still more.

In the 1980s and 1990s, theorists had hoped that there might be a vacuum 'selection process' — a natural extension of string theory that would select a single vacuum resembling our Universe. But



A. J. HANSON, INDIANA UNIV.

A cosmos folded up (simulation —not actual size).



J. KING-HOLMES/SPL

Investigator-led research will be hardest hit.

reducing all its funding by 3–5%, the EPSRC has decided to continue to fund the same number of PhD students and to prioritize support for the six themes.

It is not clear how much of the £130 million will be put into research grants in the themed areas and how much is covering inflation and the move to paying full costs.

"If what is happening is that the responsive mode is taking a bigger hit than [government-themed research], the scientific community will not be happy with that," says Peter Cotgreave, director of public affairs at the Royal Society. "People find it very uncomfortable when the decision about what to fund is made before they apply."

Not everyone thinks the shift is necessarily bad. While saying there needs to be more clarity over the decision, Richard Pike, chief executive of the Royal Society of Chemistry, says that "more focus is a good thing".

And Sue Ion, vice-president of the Royal Academy of Engineering and a member of the EPSRC council, points out the proportion of funding given through the responsive-mode channel has traditionally been high at the EPSRC. "More attention needs to be given to the directed, theme-based topics," Ion says. "They [researchers] need to look for opportunities rather than go 'woe, woe and thrice woe.'"

In 2006/2007, the EPSRC funded 36% of all UK engineering and physical-sciences researchers, including 4,347 postgraduate and postdoctoral research assistants.

Unlike the Science and Technology Council cuts, there will be no high-profile projects cancelled, but fewer grants may mean fewer jobs in the long run. "It will mean 3% to 5% fewer grants, and the average grant employs a postdoc," says Cotgreave. ■

Daniel Cressey

more recently, some theorists have begun to believe that there indeed may be as many as 10^{500} universes out there. They argue that we just happen to live in our cosmos because it can support life as we know it (see *Nature* 439, 10–12; 2006).

To date, nobody's bothered to look at how many different kinds of vacua there may be, or whether they fit into any sort of systematic categories, according to Dienes. That will be the goal of the new String Vacuum Project. Like biologists, physicists on the project will try to classify the 10^{500} solutions into different taxonomic ranks, such as kingdoms and phyla.

Among the project's main goals is to make string theory more predictive, says Gordon Kane of the University of Michigan in Ann Arbor. A major criticism of the theory is that it fails to provide experimental tests that would support or falsify it. If the vacuum project succeeds, then physicists would be able to find the class of vacua that fit with our own Universe. They can use those solutions to make predictions about what might show up in experiments such as the Large Hadron Collider — a massive proton-smasher being built at CERN, the European particle-physics lab outside Geneva in Switzerland. Kane says that, if the project works, he believes that evidence supporting string theory could emerge "within a few weeks" of the accelerator's start-up.

But others are less optimistic about the vacuum project's chances of success. There's no guarantee that the 10^{500} possibilities predicted by the theory will be easily categorized, and it's likely they won't be, says Seiberg. "It's a very complicated system," he says. Searching for the few solutions that match our own Universe will be worse than looking for a needle in a haystack, he adds. Still, he believes the project may yield interesting findings.

Others are more sceptical. Sifting through a near-infinite number of vacua provides no deeper understanding of the theory, according to mathematician Peter Woit of Columbia University in New York City, who is frequently critical of string theory. The fact that physicists are interested in a statistical approach is a sign of desperation, he argues. "It would be better to say, 'okay, [string theory] doesn't work.'"

Dienes accepts these criticisms, and concedes that the plan is "absolutely controversial". Nevertheless, he believes it is the best way forward. "The plethora of vacua is an urgent issue," he says. "I want to understand our space of possibilities." ■

Geoff Brumfiel

ON THE RECORD

"I've got a student working on an application where you enter a city and it will tell you what grades and types of marijuana are available."

Clemson University economist Todd Kendall discusses the rising trend of websites that act as consumer guides to illicit activities.

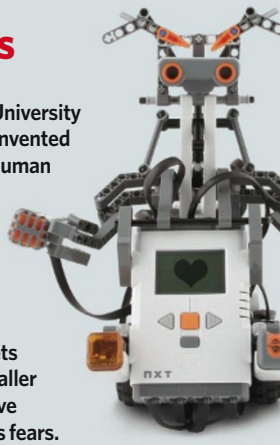
SCORECARD

WiFi
According to Google, the unused 'white space' between the frequencies used by US television stations could be co-opted to give wireless broadband to everyone in the country.

Internet users
An editorial in the *American Journal of Psychiatry* has called for Internet addiction to be added to the official inventory of mental illnesses.

ROBOT NEWS

Brave little toaster
Roboteers from the University of Amsterdam have invented a robot that mimics human phobias — and the steps needed to overcome them. The 'Phobot' retreats when it first meets a larger robot, but then gradually gets comfortable with smaller ones until it feels brave enough to conquer its fears.



T. TEN VELDEN/UNIV. AMSTERDAM

NUMBER CRUNCH

40% is the proportion of scientists and technologists in the European Union (EU) aged between 45 and 64.

27% is the proportion of people in this age bracket in the EU population as a whole. The scientific workforce is ageing faster than other sectors.

47% of senior scientists are female, which indicates that science has greater gender equality than many other professions.

Sources: Wired, BBC, Am. J. Psychiatry, Associated Press, Eurostat

SIDELINES