science-advocacy group in Alexandria, Virginia. "We don't want that to turn around now."

Scientific issues have scarcely been mentioned on the campaign trail so far. Hillary Clinton, the Democratic front runner, has pledged to boost support for research into Alzheimer's disease, and has pushed back against Trump's anti-immigration and anti-Muslim stance. When she was a senator, Clinton backed health and research-related bills, and as first lady to former president Bill Clinton, she advocated for research on women's health.

Trump is a wealthy real-estate mogul with no political legacy to mine for clues as to his scientific opinions. In the course of the campaign, he has linked autism to childhood vaccines, and dismissed climate change. ("It's called weather," he said.) In October, conservative radio host Michael Savage suggested on air that if elected, Trump should appoint him as head of the US National Institutes of Health (NIH). "Well, you know you'd get common sense if that were the case, that I can tell you," Trump replied, during the light-hearted conversation. "Because I hear so much about the NIH, and it's terrible."

With little more than this to go on, advocates of science funding are worried. "It feels like there's a lot of cynicism toward science and scientists, and that's concerning," says Benjamin Corb, public-affairs director at the American Society for Biochemistry and Molecular Biology in Rockville, Maryland.

Trump's position on immigration is clearer. He frequently boasts that if elected, he would build a wall along the border with Mexico — and force Mexico to pay for it — which has earned him both supporters and derision. A President Trump could bode ill for long-running efforts to boost the number of foreign professionals working in the United States on visas for highly skilled workers, known as H-1Bs. But Trump's statements regarding H-1B visas have been difficult to parse. At times, he has advocated bringing skilled workers into the country; at others, he has said that the H-1B programme is too often abused and should be restricted.

"There's a lot of cynicism toward science and scientists."

Such statements worry Brad Hayes, a computer scientist at the Massachusetts Institute of Technology in Cambridge. Hayes is an US citizen, but says that some of his most outstanding colleagues are not. "A lot of them want to end up here after they get their PhDs, but now that's in doubt," he says. "We absolutely want these people to stay. If they get lumped in with this 'close our borders, keep everybody out', we're doing ourselves a disservice."

Hayes inadvertently cast a spotlight on the simplicity of Trump's rhetoric when he decided to use a neural network to model Trump's noticeably repetitive and simplistic speech patterns. He has been posting the results — computer-generated parody quotes based on Trump's campaign speeches — on Twitter using the handle @DeepDrumpf. (Trump's ancestral name, Drumpf, was changed by the family several generations ago.)

"We're going to build the wall," says one tweet, in reference to Trump's Mexico plan. Hayes says that the project was only meant to be fun, but it ended up making a point. "A lot of the rhetoric that's being used is fairly content-light."

But that rhetoric is having an effect, says Ehab Abouheif, a developmental biologist at McGill University in Montreal, Canada, who is Muslim. On a recent trip to be interviewed for a position in the United States, recruiters' "constant question was, 'Are you really sure you would want to come?'" he says. "My scientist colleagues are really scared."

To Abouheif, who fondly remembers completing his PhD and his postdoc in the United States, the current climate is surreal. "If you are trying to stop Muslims from coming in, it means that the ones who are there already are not going to feel comfortable either," he says. "It would be a shame to alienate this big swathe of society." ■

COSMOLOGY

Controversial dark-matter claim faces ultimate test

Multiple teams finally have the material they need to repeat enigmatic experiment.

BY DAVIDE CASTELVECCHI

It is the elephant in the room for dark-matter research: a claimed detection that is hard to believe, impossible to confirm and surprisingly difficult to explain away. Now, four instruments that will use the same type of detector as the collaboration behind the claim are in the works or poised to go online. Within three years, the experiments will be able to either confirm the existence of dark matter — or rule the claim out once and for all, say the physicists who work on them.

"This will get resolved," says Frank Calaprice of Princeton University in New Jersey, who leads one of the efforts.

The original claim comes from the DAMA collaboration, whose detector sits in a laboratory deep under the Gran Sasso Massif, east of Rome. For more than a decade, it has reported overwhelming evidence[1] for dark matter, an invisible substance thought to bind galaxies together through its gravitational attraction. The first of the new detectors to go online, in South Korea, is due to start taking data in a few weeks. The others will follow over the next few years in Spain, Australia and, again, Gran Sasso. All will use sodium iodide crystals to detect dark matter, which no full-scale experiment apart from DAMA's has done previously.

Scientists have substantial evidence that dark matter exists and is at least five times as abundant as ordinary matter. But its nature remains a mystery. The leading hypothesis is that at least some of its mass is composed of weakly interacting massive particles (WIMPs), which on Earth should occasionally bump into an atomic nucleus.

DAMA's sodium iodide crystals should produce a flash of light if this happens in the detector. And although natural radioactivity also produces such flashes, DAMA's claim to have detected WIMPs, first made in 1998, rests on the fact that the number of flashes produced per day has varied with the seasons.

This, they say, is exactly what is expected if the signal is produced by WIMPs that rain down on Earth as the Solar System moves through the Milky Way's dark-matter halo[2]. In this scenario, the number of particles crossing Earth should peak when the planet's orbital motion lines up with that of the Sun, in early June, and should hit a low when its motion works against the Sun's, in early December.

There is one big problem. "If it's really dark matter, many other experiments should have seen it already," says Thomas Schwetz-Mangold, a theoretical physicist at the Karlsruhe Institute of Technology in Germany — and none has. But at the same time, all attempts to

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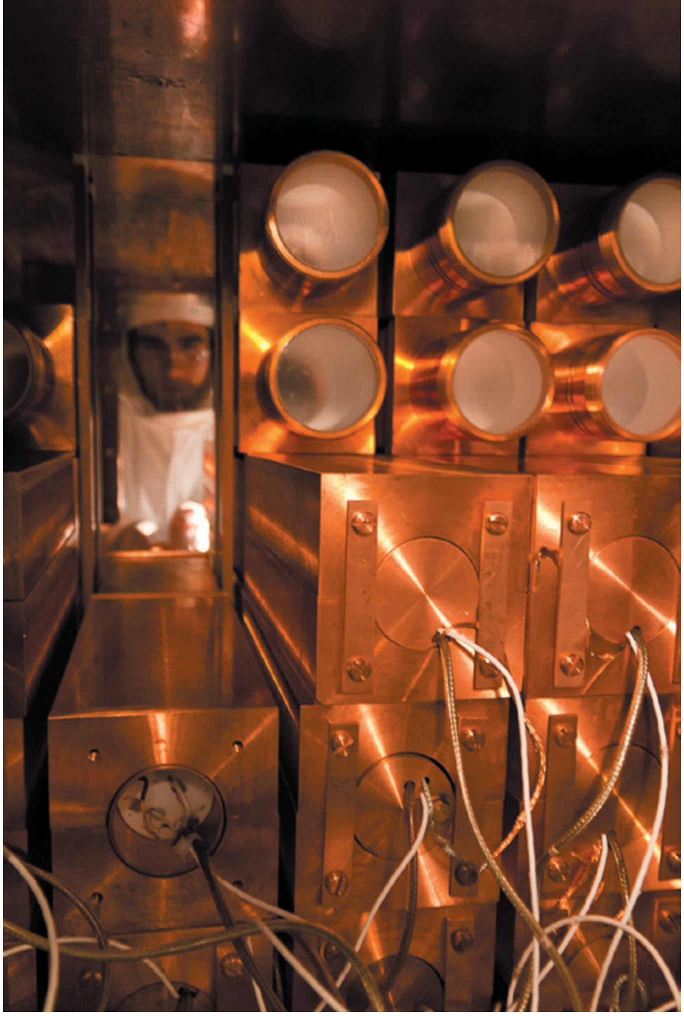
find weaknesses in the DAMA experiment, such as environmental effects that the researchers had not taken into account, have failed. “The modulation signal is there,” says Kaixuan Ni at the University of California, San Diego, who works on a dark-matter experiment called XENON1T. “But how to interpret that signal — whether it’s from dark matter or something else — is not clear.”

No other full-scale experiment has used sodium iodide in its detector, although the Korea Invisible Mass Search (KIMS), in South Korea, used caesium iodide. So the possibility remains that dark matter interacts with sodium in a different way to other elements. “Not until someone has turned on a detector made of the same material will you grow convinced that nothing is there,” says Juan Collar at the University of Chicago, Illinois, who has worked on several dark-matter experiments.

Many have found it challenging to grow sodium iodide crystals with the required purity. Contamination by potassium, which has a naturally occurring radioactive isotope, is a particular problem.



The DAMA team uses sodium iodide housed in copper to hunt for dark matter.

But now three dark-matter-hunting teams — KIMS; DM-Ice, run from Yale University in New Haven, Connecticut; and ANAIS, at the University of Zaragoza, Spain — have each obtained crystals with about twice the level of background radioactivity of DAMA’s. That is pure enough to test its results, they say.

The KIMS and DM-Ice teams have built a sodium iodide detector together at Yangyang Underground Laboratory, 160 kilometres east of Seoul. This instrument uses an ‘active veto’ sensor that will enable it to separate the dark-matter signal from the noise better than DAMA does, says Yeongduk Kim, the director of South Korea’s Center for Underground Physics in Daejeon, which manages KIMS.

ANAIS is building a similar detector in the Canfranc Underground Laboratory in the Spanish Pyrenees. Together, KIMS/DM-Ice and ANAIS will have about 200 kilograms of sodium iodide, and they will pool their data. That is comparable to DAMA’s 250 kilograms, enabling them to catch a similar number of WIMPs, they say. Even though the newer detectors will have higher levels of background noise, it should still be possible to either falsify or reproduce the very large DAMA signal, says Reina Maruyama of Yale, who leads DM-Ice.

But Calaprice argues that high purity is more important than mass. He and his collaborators have developed a technique to lower contamination, and in January announced that they were the first to obtain crystals purer than DAMA’s. He expects to reduce the background levels further, to one-tenth of DAMA’s.

The project, SABRE (Sodium-iodide with Active Background Rejection), will put one detector at Gran Sasso and the other at the Stawell Underground Physics Laboratory, which is being built in a gold mine in Victoria, Australia. SABRE will also use a sensor to pull out the dark-matter signal from noise, and will have a total mass of 50 kilograms.

SABRE should complete its research and development stage in about a year, and will build its detectors soon after that, says Calaprice. It will then make its technology available to other labs — something that DAMA did not do. And having twin detectors in both the Northern and Southern hemispheres could clarify whether environmental effects could have mimicked dark matter’s seasonality in DAMA’s results — if the signal is from WIMPs, then both detectors should see peaks at the same time.

DAMA will wait at least until 2017 to release its latest results, says spokesperson Rita Bernabei of the University of Rome Tor Vergata. She is not holding her breath about the upcoming sodium iodide detectors. “Our results have already been verified in countless cross-checks in 14 annual cycles, so we have no reason to get excited about what others may do,” she says. If other experiments do not see the annual modulation, she adds, her collaboration will conclude that they do not yet have sufficient sensitivity.

Could the teams prove DAMA right? “I was unwilling to believe the DAMA results or even take them seriously at first,” says Katherine Freese, a theoretical astroparticle physicist at the University of Michigan in Ann Arbor, who with her collaborators first proposed the seasonal modulation technique used by DAMA[2]. But, as DAMA’s data have accumulated, and no other explanation for their signal has arisen, Freese is now excited by the possibility that dark matter may have been discovered after all. The fact that many have tried and failed to repeat DAMA’s experiment shows that it is not easy, says Elisabetta Barberio at the University of Melbourne, who leads the Australian arm of SABRE. “The more one looks into their experiment, the more one realizes that it is very well done.” ■

1. Bernabei, R. *et al. Eur. Phys. J. C* **73,** 2648 (2013).
2. Drukier, A. K., Freese, K. & Spergel, D. N. *Phys. Rev. D* **33,** 3495–3508 (1986).

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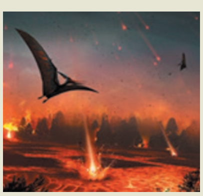

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CORRECTION

In the article 'Controversial dark-matter claim faces ultimate test' (*Nature* **532,** 14–15; 2016), the last paragraph was amended to better reflect Katherine Freese's views on the DAMA collaboration's results.