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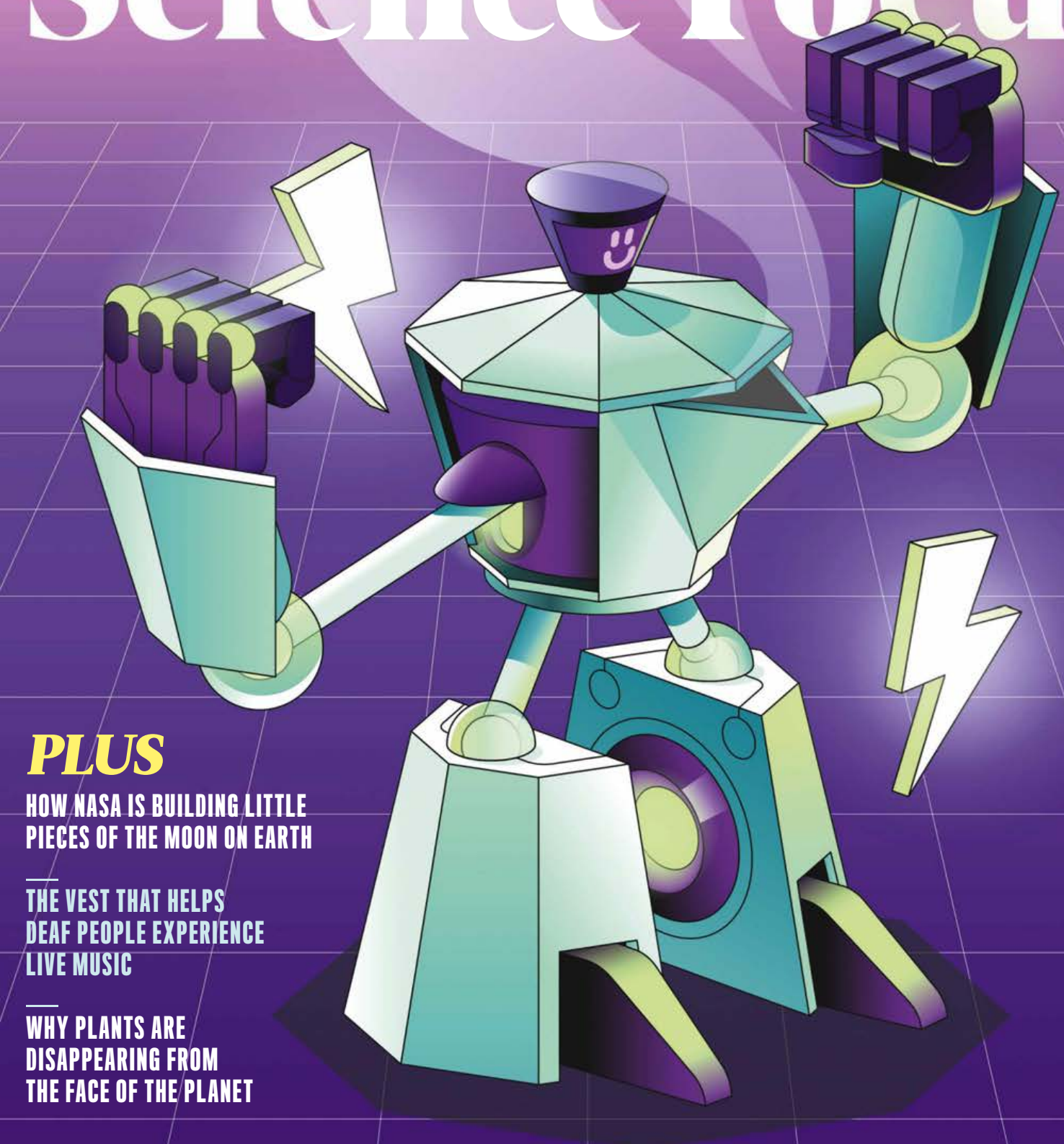

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RETHINKING CAFFEINE

HOW THE RIGHT AMOUNT UNLOCKS LIFELONG BENEFITS FOR YOUR BRAIN AND BODY

ABOVE The rise in the amount of sick days we're taking, especially relating to mental health, is concerning experts

→ the increasing impact of mental health issues in the workplace, with 63 per cent of organisations listing mental health in the top three reasons for illness lasting longer than a month, and 37 per cent listing stress as a reason.

"Mental health has been an increasing cause for concern for many years," says Suff. "But the last three years have been really challenging for people."

She cites the long tail of the pandemic and the cost of living crisis as factors affecting people's wellbeing, but points to data from the report suggesting that heavy workload is the reason most often given for stress-related absence.

Trying to tease out how COVID plays into all of this is by no means straightforward, partly due to low levels of testing at the moment. While the CIPD data includes a separate category for the virus, it could easily be mistaken for other minor illnesses such as colds or flu, which are listed by 94 per cent of organisations as a main cause of short-term sickness.

Any long-term impacts of COVID are even harder to decipher. But, according to Patel, it's unreasonable to think that the big spike in sick leave is all due to COVID. "I think that's obviously not true," he said.

SO, WHAT NEEDS TO CHANGE?

According to Suff, it's crucial that organisations get a better handle on what's causing sickness absences, not just in the general population, but among their own staff.

"The pandemic and mental health – they're all part of the bigger picture," she says. "But you've got to drill down into what's going on in your organisation, look at all the data and then see what you can do to support people better."

by **HAYLEY BENNETT**

Hayley is a science writer based in Bristol, UK.

ANALYSIS

ANTIGRAVITY: A RECENT TEST RESULT MIGHT HAVE RULED IT OUT

Hoverboards and flying cars may be off the cards... but dark energy may yet come to the rescue

According to first Newton, then Einstein, and now an experiment at CERN, gravity is an attractive force that exists between all objects in the Universe. That includes objects that have no mass, because gravity acts on energy, and mass is just one form of energy (as Einstein's most famous equation states, energy is equal to mass multiplied by the square of the speed of light). This is why even massless photons of light, travelling from distant stars, have their paths bent as they pass massive galaxies on the way.

Antigravity is a hypothetical repulsive gravitational force. In some ways, it sounds obvious that it should exist. There are both attractive and repulsive electric forces, so why not the same for gravity?

The difference is that electric charge comes in two types, positive and negative. Different charges (a positive and a negative) will attract each other, while charges that are alike (two positives or two negatives) repel each other. The equivalent of 'charge' for gravity is energy, and it only comes in one type: positive.

As these positive energies attract each other there doesn't seem to be room for antigravity, which is a pity because it would be a great way of flying around without the need for rockets, jet engines or even wings.

However, there is (or was, until this month) a possible get-out clause for antigravity: antimatter.

Antimatter isn't hypothetical, it's very real. Particles such as electrons have an antimatter equivalent. The antiparticle of the electron is the positron, and it has not only been observed, but is regularly used in hospitals for diagnostic purposes.

Positrons emitted from unstable elements injected into a patient's body will give off a very distinctive energy signal when they meet an electron and annihilate. The signal is so distinctive that the point of annihilation can be identified very precisely.

The whole process, known as Positron Emission Tomography (PET), gives doctors unique information on the soft tissues and flow of material around a body.

Antimatter has the opposite electric charge to matter, so does it also have the opposite gravitational charge, and so experience antigravity? This was the question the ALPHA-g experiment at CERN was designed to answer. Does antimatter fall down or up?

Producing antiparticles is quite easy. Accelerators such as those at CERN can make many positrons

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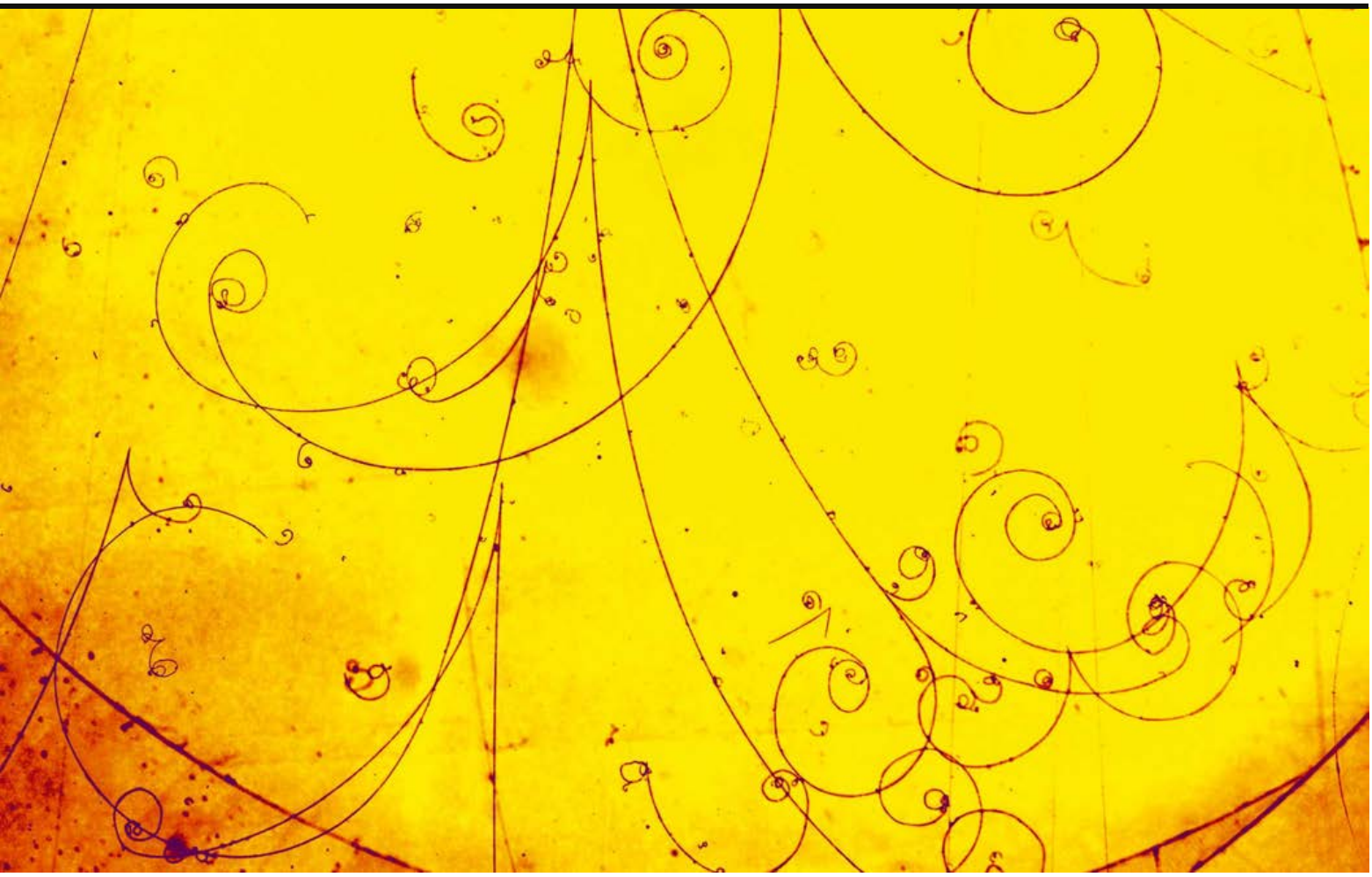
"In some ways, it sounds obvious that it should exist. There are both attractive and repulsive electric forces, so why not the same for gravity?"



and antiprotons. That's fine, but these particles have electric charge, and they are also in general moving at high speed. Neither of those things is good if you want to measure the effect of gravity, because gravity is really, really weak.

Just think: your muscles, which use the electromagnetic force, can pick up a pen or paper, thereby counteracting the gravitational attraction of an entire planet.

So any tiny stray electric field in your experiment could easily obscure the effect of gravity on a charged particle like a positron or antiproton. And anyway, they'll have sped away before you could see which way they fall. The antiproton decelerator at CERN is designed to combat this; to slow down antiprotons, and eventually bring them together with positrons to make electrically neutral antihydrogen. In a similar way in which an atom of hydrogen is made up of a single proton and an electron, an atom of antihydrogen is made up of a single antiproton and a positron.

ABOVE Tracks of electrons and positrons. The antiparticle of the electron, spiralling anticlockwise, is the positron, spiralling clockwise

The ALPHA (Antihydrogen Laser Physics Apparatus) experiment at CERN's Antimatter Factory has seen researchers collecting antihydrogen atoms and studying them since 2013, and this month they published results from a new setup, called ALPHA-g, where the g stands for gravity.

The idea is very simple – trap a few hundred antihydrogen atoms in a vertical tube, let them →

ABOVE The Antimatter Factory at CERN where the ALPHA experiment studies symmetries between matter and antimatter

→ diffuse around, and measure how many come out of the top and how many come out of the bottom. The experiment is structured so that if gravity affects antimatter in the same way it affects matter, 80 per cent of them should drop out of the bottom, while 20 per cent would diffuse out of the top of the experiment by 'bouncing' up.

Within the precision of the experiment, that's exactly what happened. Antimatter falls down, like normal matter. Now, is this the end of the road for antigravity? Not really.

But it does signal the end for a certain type of antigravity. We won't be getting antigravity rockets (or hoverboards) riding on a cushion of antimatter, for example.

However, while most scientists are profoundly unsurprised by this result, a form of antigravity is actually built into our current best understanding of cosmology. Astrophysical measurements indicate that the rate of expansion of the Universe is increasing, meaning that some force is counteracting the gravitational attraction between the matter in the Universe, and actually pushing it apart. We call this dark energy, but we could just as well have called it 'antigravity'.

In fact, there were even cosmological theories that proposed that half the Universe was made up of antimatter, and that this was repelling the matter and thus providing the dark energy effect.

Such ideas also potentially solved some other problems with our understanding of cosmology – although they created a whole bunch more. Either way, in light of the ALPHA-g result, it seems they're wrong, and there must be something else behind the antigravity.

by **PROF JON BUTTERWORTH**
Jon is a Professor of Physics at University College London. He works on the ATLAS experiment at the CERN Large Hadron Collider.

COMMENT

BORDERLINE PERSONALITY DISORDER: WHY IS IT STIGMATISED?

Despite being recognised for decades, the condition remains misunderstood and undertreated as a result

The so-called 'personality disorders' are among the most controversial and complicated of psychiatric diagnoses. Critics say that stigma is baked into the concept itself – the label implies that there is something pathological about a person's personality.

The term 'personality disorder' is meant to reflect how a person's psychological problems are long-lasting and permeate many aspects of their lives, from their daily emotional experiences to their relationships.

For some, receiving a formal diagnosis of a personality disorder can help them understand why they find life so difficult and, in positive cases, it can help them obtain the professional support they need.

Of the 10 specific personality disorders recognised by psychiatry, among the most widely misunderstood is borderline personality disorder (BPD), which is estimated to affect one to two per cent of the population.

The term 'borderline' is a throwback to the 1930s. During this time, psychoanalytically trained psychiatrists saw the diagnosis as being on the margins of the now largely defunct categories of the psychoses (conditions that were considered more serious and untreatable) and the neuroses (conditions that were considered treatable with psychoanalysis).

People with BPD typically experience a lot of anxiety; they worry about being abandoned by people close to them; they often struggle to form a stable sense of who they are; and they can find stress particularly difficult to cope with.

It can prompt them to act impulsively, to experience paranoid feelings or a sense of being detached from reality. To try to cope, people with BPD will often self-harm and they might think about taking, or try to take, their own life.

As well as fearing abandonment, another common experience for people with BPD is to swing from one extreme to the other in terms of how they feel about people close to them. One day they see family and friends as perfect, the next they believe those same people have let them down and are really bad. Inevitably, this can contribute to difficulties in close relationships for everyone involved.

There are competing theories for what is going on in BPD. For instance, one influential account states that BPD is an emotional regulation problem – people with the condition experience particularly intense and prolonged difficult

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