# New Scientist

WEEKLY 19 February 2022

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Why a weekly session could protect your heart

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The viral threats hiding in our thawing permafrost

## MAKING A MIND

How to create an artificial intelligence that really thinks like us

**DON'T SIT UP STRAIGHT**
Why the rules of good posture are being rewritten

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to cut the time it takes from sequencing a child's tumour to giving them a personalised treatment from 12 to six weeks on average, and hopes to get it down to four.

The programme currently costs A$10,000 per child for the tumour sequencing and analysis, plus extra for the studies in cells and mice and the drugs that end up being prescribed.

Other countries are experimenting with personalised medicine programmes for children with cancer, but Zero is the most comprehensive to date, says Mayoh. "I think it's only a matter of time before other countries follow."

**"When his mum was out of the hospital room, he would turn to me and say, 'Dad, am I going to die?'"**

Zero was recently named by the US National Advisory Council for Human Genome Research as being one of the top 10 accomplishments in genomic medicine implementation.

The scheme has also now secured another A$55 million from the Australian government to make it available to every Australian child with cancer from next year, not just those with the worst cancers.

Haber is confident we will get to a point where zero children die of cancer, especially as new immunotherapies and other treatments become available. "In the 1950s, cancer was a death sentence for children, and now the survival rate is over 80 per cent," she says. "I do think that personalising treatments – making sure you get the right drug for the right child at the right time – will get us towards our goal of one day curing all children of cancer." ▮

Astronomy

# Rare 'hyperburst' is powerful nuclear explosion in space

Jonathan O'Callaghan

**ASTRONOMERS think they have found evidence for an extremely powerful nuclear explosion in space – one so rare that we are unlikely to ever see its like again.**

**The explosion seems to have taken place inside a strange neutron star located 140,000 light years from Earth called MAXI J0556-332. Neutron stars are the remnant cores of larger stars that have exploded in supernovae, leaving city-sized objects that contain up to twice the mass of our sun. MAXI J0556-332 was discovered in 2011, paired with another larger star. It has confused astronomers ever since, as it was twice the normal temperature of neutron stars when it was first spotted, though it has since cooled.**

**Now we might know why. Dany Page at the National Autonomous University of Mexico and his colleagues think a huge and unstable thermonuclear explosion may have taken place inside the neutron star. The event, which they dub a "hyperburst", was so deep inside the star it was undetectable. It would have caused significant heating, explaining the gargantuan spike in temperature (arxiv.org/abs/2202.03962).**

**"Finally, we have a physical explanation why it is so hot," says Page. "Everything makes sense."**

**Neutron stars in pairs like this can gain material from their companion star, sucking huge amounts of gas onto their surfaces. This process makes the neutron star very hot, and can also result in detectable bursts near the surface when hydrogen and helium burn, which can happen as frequently as every few minutes. More powerful bursts, known as superbursts, occur every few years as heavier carbon is burned about 100 metres below the surface of the neutron star, releasing 100 times more energy than a regular burst.**

**The team's modelling suggests hyperbursts would be 100 times stronger still and occur 500 metres below the surface, deep inside the ocean of thick plasma that encompasses neutron stars. They would result from the burning of oxygen, which would build up to eventually "generate more energy than can be leaked away", says Page, with temperatures approaching 400 million °C. The result would be an explosion that released more energy in a matter of milliseconds than our sun does in 100,000 years – but it would be undetectable from outside the neutron star because of its depth.**

**Pushing enough matter into the neutron star to drive this explosion, however, would take a long time. "You have to wait for maybe 1000 years," says Page. The neutron star must also have stopped gaining material from its companion in order for the temperature of the explosion to be noticeable, something only seen in a handful of binary neutron stars. This rare combination of circumstances means this might be the only hyperburst we ever witness. "We're lucky to have one," says Page.**

**Anna Watts at the University of Amsterdam says it is a "really interesting idea", noting that previous attempts to explain this neutron star's unusual temperature relied on a "hand wavy" idea called shallow heating. This suggested there was some sort of heating process taking place in the crust of the neutron star, but the science was uncertain. "A hyperburst would certainly solve the energy problem," says Jean in 't Zand at the Netherlands Institute for Space Research.**

**There might be an unusual way to test the idea: by never observing a hyperburst again. This would suggest Page's idea for their rarity is correct. "You just really hope they don't find another one now," says Watts, a somewhat strange wish for a potentially new astronomical discovery.** ▮

SHUTTERSTOCK/MIK ULYANNIKOV

An artist's impression of a large explosion in space