# New Scientist

**WEEKLY** November 14–20, 2020

SPECIAL REPORT

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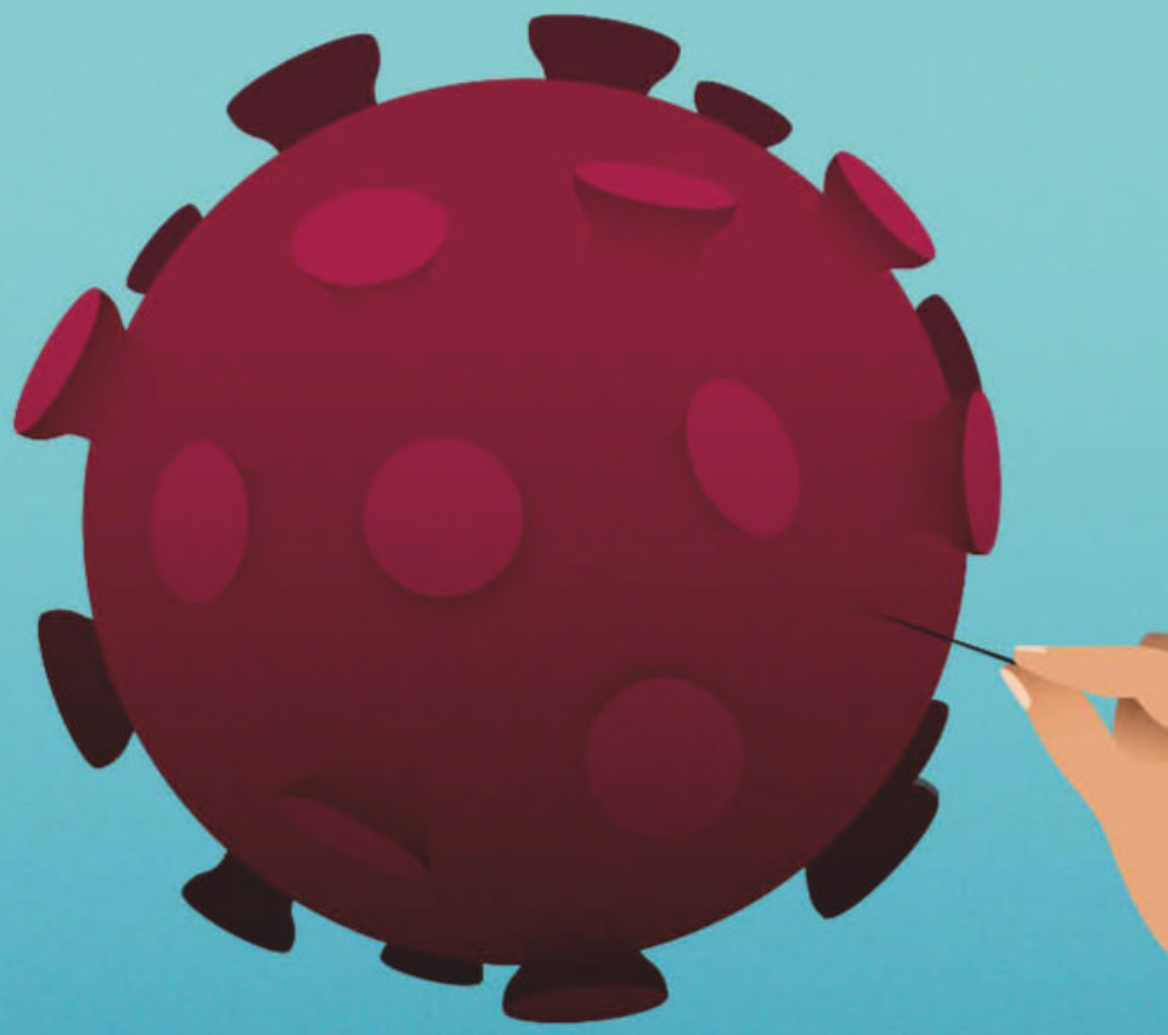
How excited should we be?



## ANIMALS WITH CORONAVIRUS

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## MYSTERY SPACE SIGNALS

Radio burst tracked to its origin for the first time

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Astronomy

# Space mystery solved

Strange blasts of radio waves have been spotted all over the cosmos. Now we have finally tracked one to its source, reports **Leah Crane**

FOR the first time, we have tracked a strange blast of radio waves – called a fast radio burst (FRB) – back to its source, solving a major cosmic mystery. The burst came from a magnetar, a neutron star with a strong magnetic field.

"I think what's really surprising is that we saw anything at all in our own galaxy, given how rare these fast radio bursts are," says Christopher Bochenek at the California Institute of Technology, who helped observe the FRB.

The bursts are incredibly powerful flashes of radio waves that mostly come from distant galaxies. Since the first one was discovered in 2007, many explanations for them have been put forward.

However, because they tend to come from so far away, there was never enough evidence to determine what exactly was making them. Some FRBs have been tracked back to their host galaxies, but their source hasn't been pinpointed.

In April, astronomers found an FRB coming from within our own galaxy for the first time, allowing them to take a closer look at one of these relatively rare phenomena. Several teams of researchers examined the area where it arose and found that the burst originated from a magnetar called SGR 1935+2154 (*Nature*, doi.org/ghhw2m).

Although magnetars have been a favoured contender to explain FRBs, this is the first evidence that they can produce radio waves at high enough energies to account for the signals.

This particular burst, known as FRB 200428, came from about 30,000 light years away from us, whereas the others we have detected were millions to billions of light years away.

"It's bridging the gap between activity in our own galaxy and these strange events from many light years away," says Brian Metzger at Columbia University in New York, who wasn't involved with this research.

The proximity of this burst made it appear extremely bright. "It is much brighter than any other radio object in space, by a large margin," says Bing Zhang at the University of Nevada, Las Vegas, part of the team that connected the FRB to its magnetar source.

The burst had an energy about three times that emitted every second by the sun. It was also far brighter than any radio waves ever observed from a magnetar before, although it didn't release quite as much energy as any of the FRBs outside our galaxy.

That may mean that the other FRBs we have seen are produced by more active magnetars that can emit more powerful blasts.

"If all the FRBs are produced by magnetars, they cannot all be slow, old magnetars like this one," says Zhang. "Some must be young, meaning decades or centuries old instead of thousands of years or tens of thousands."

**"It's still too early to say whether 99 per cent of the FRBs are from magnetars or 10 per cent"**

However, it is also possible that not all fast radio bursts are produced by magnetars.

"When we talk about FRBs, we say it like it's an object, but they're not objects, they're bursts, and I think that we will be able to see these bursts from a whole host of other kinds of objects beyond just magnetars," says Amanda Weltman at the University of Cape Town in South Africa.

There have been hints that different kinds of FRB exist. Some of them seem to repeat, bursting again and again, while others have only been spotted flashing once. Plus, the few FRBs that have been traced back to their host galaxies seem to reside in a variety of environments.

"I think it's still too early to say whether 99 per cent of the extragalactic FRBs are from magnetars or whether it's 10 per cent," says Metzger.

This single burst won't enable us to answer the question of whether there are many types of objects that make FRBs, but it may help us understand the nitty-gritty of one type.

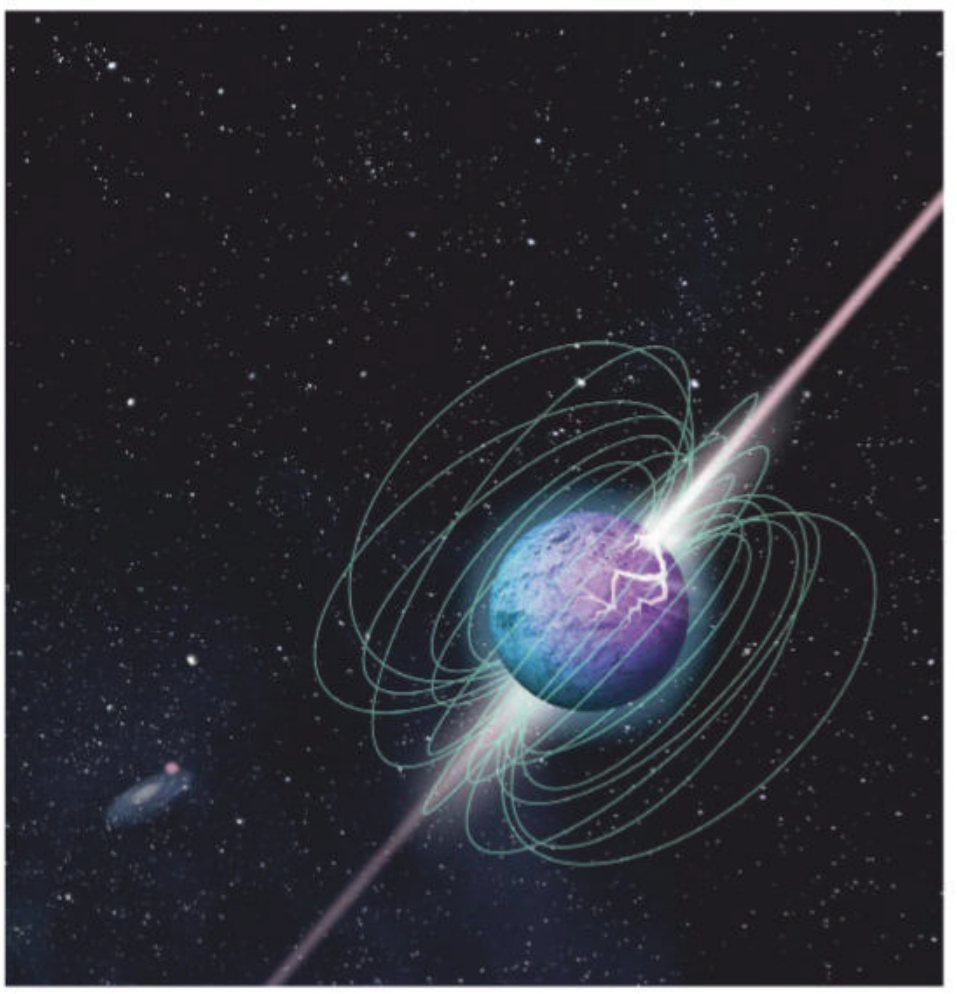
"Even if these are all coming from magnetars, there are multiple different ways a magnetar could produce this radiation and hopefully this will help us start to arbitrate between them," says Metzger.

Astronomers will be watching the other known magnetars in our galaxy for more flares of radio waves, says Weltman.

"To see a quick burst like this, you have to happen to have your telescope looking in the right direction at the right time – there's no end of luck involved," she says. "This is only the very, very beginning for FRB science. I think there will be tens of thousands observed in different galaxies within a couple of years."

Once we have a larger sample of FRBs and a better grip on the full breadth of their behaviour, it will become far easier to determine what is creating them all and how. Although much is still unknown about FRBs, this discovery is a sign that we may soon be able to put together the rest of the puzzle. ▮

MCGILL UNIVERSITY GRAPHIC DESIGN TEAM



**A magnetar emitting a blast of radiation known as a fast radio burst**