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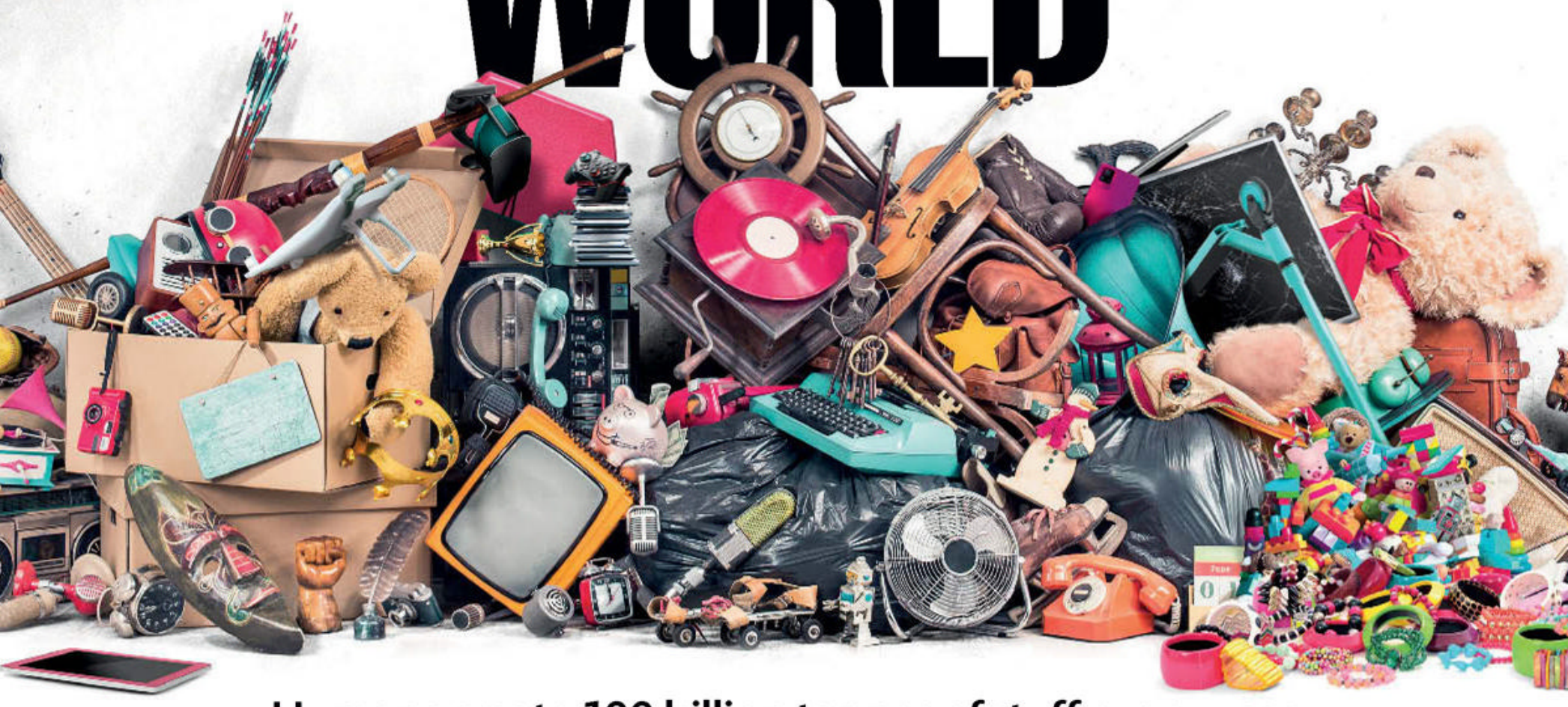

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Astronomy

Rogue black hole found drifting alone through interstellar space

Alex Wilkins

AN ISOLATED stellar-mass black hole has been detected for the first time.

Astronomers typically spot black holes by measuring their interactions with nearby stars, which can produce vast plumes of gas or radiation. Isolated stars, which astronomers have observed in their millions, imply that isolated black holes should also fill the sky, as dying stars can birth black holes once they explode in a supernova. "[Isolated stellar-mass black holes] aren't rare, but they've never been found," says Kailash Sahu at the Space Telescope Science Institute (STSI) in Maryland.

Now, Sahu and his team have spotted one of these untethered black holes about 5000 light years away in the constellation Sagittarius. To detect it, they used the Hubble Space Telescope and a phenomenon called microlensing, in which the gravity from massive objects, such as black holes, can bend and magnify the light of stars that they pass in front of.

The brightening and bending of light is minuscule when viewed from Earth – the star that Sahu and his team observed moves about 25 millimetres when viewed fromaround 2500 kilometres away. "It's so astonishing that we can measure an angle that small, but with the Hubble Space Telescope, it's possible," says Howard Bond at STSI.

The first hints of this black hole's existence were found in 2011, when a star appeared to grow much brighter than normal.

An artist's impression of an isolated black hole

SHUTTERSTOCK/VADIM SADOVSKI

The star was then observed over almost seven years to disentangle its motion. "You have to observe this event long enough to separate the ordinary straight-line motion of the background star from the extra deflection due to the foreground black hole," says Bond.

Sahu and his team calculated the mass of whatever was causing the light to bend to see if it had contributed any light to the star's apparent brightness. They found a lens that gave off no light and had a mass around seven times that of our sun, which had only one plausible explanation: an isolated black hole (arxiv.org/abs/2201.13296).

This isn't the first time that astronomers have thought they had found an isolated stellar-mass black hole. Previous brightening events have been observed that could be possible candidates, but they were less solid observations. "You couldn't really tell whether they were black holes or whether they were just very, very slow-moving, low-mass stars," says Christopher Reynolds at the University of Cambridge. "But using this astrometry technique has broken that [uncertainty]."

Rogue supermassive black holes have been found before, but the only way to detect them was by the light of the matter they consume, suggesting they were surrounded by other cosmic objects. "The very fact that we were able to 'see' those rogue supermassive black holes meant that they were surrounded by an accretion disk or star cluster. The case in point here is truly alone and we're only seeing it due to its gravitational effect on background light," says Reynolds. ▮

Music

English language and Japanese songs evolved in same way

JAPANESE folk songs developed in the same way as English language ones even though they are sung in different tones and scales.

Patrick Savage at Keio University in Japan and his colleagues analysed the musical notation of more than 10,000 folk songs. Of these, 4125 were sung in English and 5957 in Japanese.

There are a few differences between Japanese and English folk songs. For example, those from Japan use a five-note musical scale, whereas English ones typically use a seven-note scale. They are also quite different tonally.

However, the researchers were looking specifically at how the two musical genres evolved and whether there were any similarities between them. They first converted the musical notations of the folk songs into letter sequences that could be read by an algorithm that usually tracks evolutionary changes in nature.

"It is difficult to tell which version of a song or which style of melody came first," says Savage. This means that when the researchers compared two similar songs, they couldn't say for sure whether a difference in the number of notes between the two was due to an insertion or a deletion – so they treated all of these sorts of changes as the same.

They could, however, distinguish insertions/deletions from note substitutions, where the number

"Note substitutions were less likely than note insertions or deletions in all the folk songs"

of notes in a melody is the same in two songs, but a given note has a different value in each song.

The researchers found that these note substitutions were less likely than note insertions or deletions in both Japanese and English folk songs (*Current Biology*, doi.org/hfs4).

"We think this is because note insertions or deletions don't really affect the melody too much," says Savage. "Substitutions, like singing everything in a lower note, obviously messes up the melody a lot more." ▮

Jason Arunn Murugesu