New Scientist

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Astronomy

Passing star could fling Earth past Pluto into the Oort cloud

Leah Crane

IF A passing star came near the solar system, Earth would probably be fine – but there is a small chance our entire world could get thrown to the outer reaches of the solar system, crash into another planet or even get stolen by the wandering star. The other planets in the solar system could suffer similar fates, and Mercury in particular would be at risk of falling into the sun.

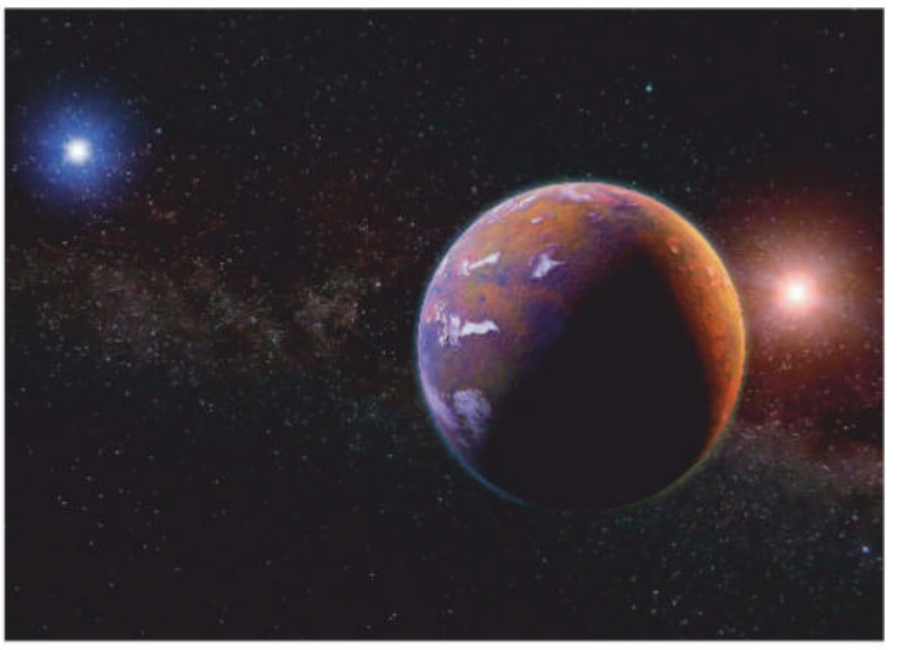
About a billion years from now, the sun's evolution will have proceeded enough that our solar system's habitable zone will have moved out beyond Earth's orbit, meaning our planet's surface will broil.

But over that same time period, there is about a 1 per cent chance that another star will fly within 100 astronomical units (or AU, the distance between Earth and the sun) of our solar system.

To determine what effect such a flyby would have on the solar system, and whether it could save Earth, Sean Raymond at University of Bordeaux in France and his colleagues performed a set of 12,000 simulations.

If such a flyby happens while we are still around to see it, it will look spectacular. "Over about a thousand years, we would see an object about as bright as Venus slowly moving across the sky until it became as bright as the full moon," says Garett Brown at the University of Toronto in Canada, who wasn't involved in this research. "It would be very bright, but even at 100 AU it would still only look half the size of Jupiter."

The simulations suggest there is a 92 per cent chance all the planets would be fine, surviving the flyby on orbits similar to the ones they are on now. "I thought more would happen," says Raymond. "It's really not that easy to mess with planets' orbits – a star has to get really into another star's business to mess with its planets. But that means we shouldn't hold our breath for a star to come and rescue Earth from the sun."



SHUTTERSTOCK/DOTTED YETI

The arrival of a second sun could leave Earth out in the cold

In fact, the researchers found there is only a 0.28 per cent probability, should a close stellar flyby happen, of Earth ending up in a cooler, and therefore more habitable, location: generally either getting tossed out into a region of icy objects beyond Pluto called the Oort cloud or being captured by the other star. The odds are about the same that Earth would fall into the sun, and slamming into another planet is nearly twice as likely as either scenario.

"A star has to get really into another star's business to mess with its planets"

Even if Earth does end up in a cooler orbit, the disruption to the whole solar system could change the moon's orbit as well. "The cases when Earth ends up on a cooler orbit are going to be, quite frequently, the cases where the moon falls on us," says Raymond. "That's not good for life."

In a close stellar flyby, the second most likely outcome – after everything turning out fine – is that Mercury would smash into the sun, which has a probability of about 2.54 per cent.

Mars falling into the sun is the next most likely, followed by Venus hitting another planet, and there is about 2 per cent chance that either Uranus or Neptune would get ejected from the solar system entirely (*Monthly Notices of the Royal Astronomical Society*, doi.org/k7jh).

So if another star does pass by, we are probably better off hoping that we stay in the 92 per cent of scenarios where nothing major changes, rather than planning for cosmic salvation. ▮

Medicine

Ultrasound could deliver vaccines without needles

Karmela Padavic-Callaghan

VACCINES can be pushed through the skin using ultrasound. This doesn't damage the skin and eliminates the need for needles.

Darcy Dunn-Lawless at the University of Oxford and his colleagues mixed vaccine molecules with tiny, cup-shaped molecules made of protein. They applied this liquid mixture to the skin of mice and exposed it to ultrasound, like that used for imaging in pregnancy, for about a minute and a half.

At first, the ultrasound pushed the mixture into the upper layers of skin, where the shape of the protein molecules caused bubbles to form. As ultrasound kept hitting the skin, the bubbles burst, pushing the vaccine deeper. The action of the bubbles breaking also cleared some dead skin cells, making the skin more permeable and allowing more vaccine molecules through.

A needle pushes vaccine molecules into muscles beneath the skin, while the ultrasound technique just delivers the vaccine to the upper layers of skin. But this more shallow process is sufficient for immunisation, says Dunn-Lawless.

In tests with live mice, the researchers found that while the ultrasound method delivered 700 times fewer molecules of vaccine than conventional jabs, the animals produced more antibodies. The researchers say the mice didn't show signs of pain and there was no visible damage to their skin. The increased production of antibodies may be because there are more immune cells in the skin than in muscle, says Dunn-Lawless. He presented the research at the Acoustics 2023 conference in Sydney, Australia, on 4 December.

Kate Edwards at the University of Sydney says needle-free vaccines could lower the barrier for vaccination for some people, but data on their safety in humans would be needed. ▮