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Dr Dejan Stojkovic professor of cosmology

Horizons

Is there a wormhole hiding at the centre of the Milky Way?

Many people believe wormholes only exist in the realm of science fiction. But some astronomers think these phenomena could be real. To find out for sure, a group of researchers based in China and the US are looking at objects near Sagittarius A*, the supermassive black hole at the centre of our Milky Way. The aim is to find out whether the black hole might actually be a wormhole instead. Dejan Stojkovic, of the University at Buffalo, New York, is taking part in the research

WHAT IS A WORMHOLE?

A wormhole is an object connecting two distant parts of the same universe, or two different universes altogether. It is a hypothetical object that has never been observed so far, but it is a legitimate solution to Einstein's equations. As such, there is a great chance that it is realised somewhere in nature.

HOW DID YOU GET INTERESTED IN WORMHOLES?

In my research, I always pay most of my attention to interesting problems at the very boundary of our knowledge. Wormholes certainly fit into this description.

CAN YOU EXPLAIN YOUR NEW TECHNIQUE FOR FINDING THEM?

A traversable wormhole allows for particles and fields to travel through it. Gravitational perturbations caused by massive objects on the other side of the wormhole would affect the motion of objects, for example stars, on our side. We calculated these perturbations and applied them to the motion of stars we observe around the centre of the Milky Way [where the supermassive Sagittarius A* black hole is located].

HOW WOULD STUDYING THE STARS AROUND A BLACK HOLE HELP DETERMINE WHETHER THERE IS A WORMHOLE?

A black hole has a point of no return, called an 'event horizon', and something called a 'singularity' [a point of infinite density] at the centre. A wormhole is regular and allows for a smooth travel from one side to another. Since we cannot send probes and spacecraft through a wormhole or a black hole in order to see the difference, the only way to distinguish them is to observe motion of objects around them.

GETTY IMAGES

ABOVE Could the black hole at the centre of the Milky Way actually be a wormhole? Researchers are trying to find out

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“A traversable wormhole allows for particles and fields to travel through it”
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IN YOUR WORMHOLE RESEARCH, YOU STUDIED THE STAR S2, WHICH IS ORBITING SAGITTARIUS A*. WHY DID YOU PICK THIS STAR?

It is the best-studied star orbiting what is believed to be a supermassive black hole at the centre of the Galaxy. We know the motion and orbit of S2 with great precision. Deviations from the expected orbit could indicate that the supermassive central object might be something as exotic as a wormhole.

HOW DOES A WORMHOLE STAY OPEN?

You need some form of repulsive

gravity to prevent its collapse. Either some exotic form of negative energy density, or some elaborate setup that serves the same purpose: to provide repulsion.

WHAT'S NEXT FOR YOUR RESEARCH?

The gravitational perturbations of S2 could be caused by some other invisible objects on our side, say smaller black holes. If the deviations are observed, we would have to do more careful modelling to pinpoint the source of perturbations. That is what we are concentrating on right now. I expect that within a decade, we

will have the necessary precision to exclude the most generic wormhole scenario for the centre of the Galaxy. This, however, would not exclude their existence somewhere else in our Universe. The same techniques we proposed can be applied to any other black hole and star binary system.

DR DEJAN STOJKOVIC

Dejan is a cosmology professor at the University at Buffalo, New York. Interviewed by science writer Abigail Beall.