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Physics

Portal-like "ring wormholes" could be used as a time machine

Leah Crane

WORMHOLES are often thought of as tunnels through space-time with black holes for entrances, but they could theoretically be flat instead, like a door into another location, another universe or the past.

These "ring wormholes" would be made up of a string of exotic matter with negative energy – a property that is possible due to quantum effects, but only, as far as we know, in extremely small amounts. Because of the way this exotic matter would warp space-time, a circle made of one of these strings would act as a sort of portal to another area of space-time.

"You could go through and not even notice that you went to another universe," says Andrei Zelnikov at the University of Alberta in Canada.

Zelnikov and his colleagues calculated that such a wormhole could actually allow you to travel through time as well. If the entrance of the wormhole were placed in a higher gravitational field than the exit – meaning one is near lots of matter and the other isn't – the two sides of the wormhole would experience the passage of time at a different rate. This is due to a known effect of general relativity called gravitational time dilation (*Physical Review D*, doi.org/kj44).

SHUTTERSTOCK/JBRUIZ

A ring wormhole could let you travel to the past

That means that if you passed through the wormhole and then came back, you would effectively travel through time. "The time machine is a natural consequence of the wormhole existing," says Toby Wiseman at Imperial College London. "Apart from the crazy matter that makes up the wormhole, there's nothing too wild being postulated here, and then the consequence is something even more crazy."

This wouldn't allow unlimited time travel, says Zelnikov. You would never be able to travel back in time to before the wormhole became a time machine. "Mathematically, you can go to the past, and your older self and younger self meet," he says. "There are many logical paradox problems, but mathematically there are no contradictions."

Practical issues are another story entirely. "I doubt there is any way to make such a string with known matter fields, so probably this is not a physically possible situation," says Aron Wall at the University of Cambridge. "But we can still ask what would happen."

Then there is another issue: some prior work has suggested that once anything that would allow you to travel back in time like this has formed, quantum effects would obliterate it.

"It may be impossible, if you take into account quantum effects, but nobody knows how to take into account quantum effects in space-time," says Zelnikov.

Even if these effects make it impossible for ring wormholes to exist, their relative simplicity compared with regular wormholes means studying them could help us understand these quantum wrinkles better, or why time travel seems to be off-limits in our universe, says Wiseman. ▮

Animals

Snub-nosed alligator chomped on snails

A STRANGE reptile fossil found 18 years ago has now been identified as an ancient alligator species that had an unusually short snout and may have feasted on snails.

When the near-complete skull was first unearthed in north-east Thailand in 2005, experts weren't sure what they were looking at, other than that it was probably an alligator species. "The skull was really bizarre," says Márton Rabi at the University of Tübingen in Germany. "It was screaming that it has to be a new species."

He and his colleagues recently took up the task of identifying the creature. Using computerised tomography scans, the researchers compared the mystery skull with those of four extinct alligator species and seven living species, including American alligators (*Alligator mississippiensis*), Chinese alligators (*Alligator sinensis*) and spectacled caimans (*Caiman crocodilus*).

A handful of unique characteristics stood out: a short snout, a tall skull and a broad head. The reptile also had fewer tooth sockets than other alligators its size and its nostrils were further from the end of its snout. Large tooth sockets in the back of its mouth indicate the alligator had chompers capable of crushing hard shells, suggesting its diet included snails.

GUSTAVO DARLIM/MÁRTON RABI

Skull of the newly identified *Alligator munensis* (top) and *Alligator sinensis* (bottom)

These unusual traits led the team to conclude it was a separate species, which they named *Alligator munensis* after the nearby Mun river. Fossils of nearby species suggest the short-snouted alligator could have lived up to 200,000 years ago or as recently as a few thousand years ago. There are no clues yet as to why the alligator went extinct (*Scientific Reports*, doi.org/kj4x). ▮

Corryn Wetzel