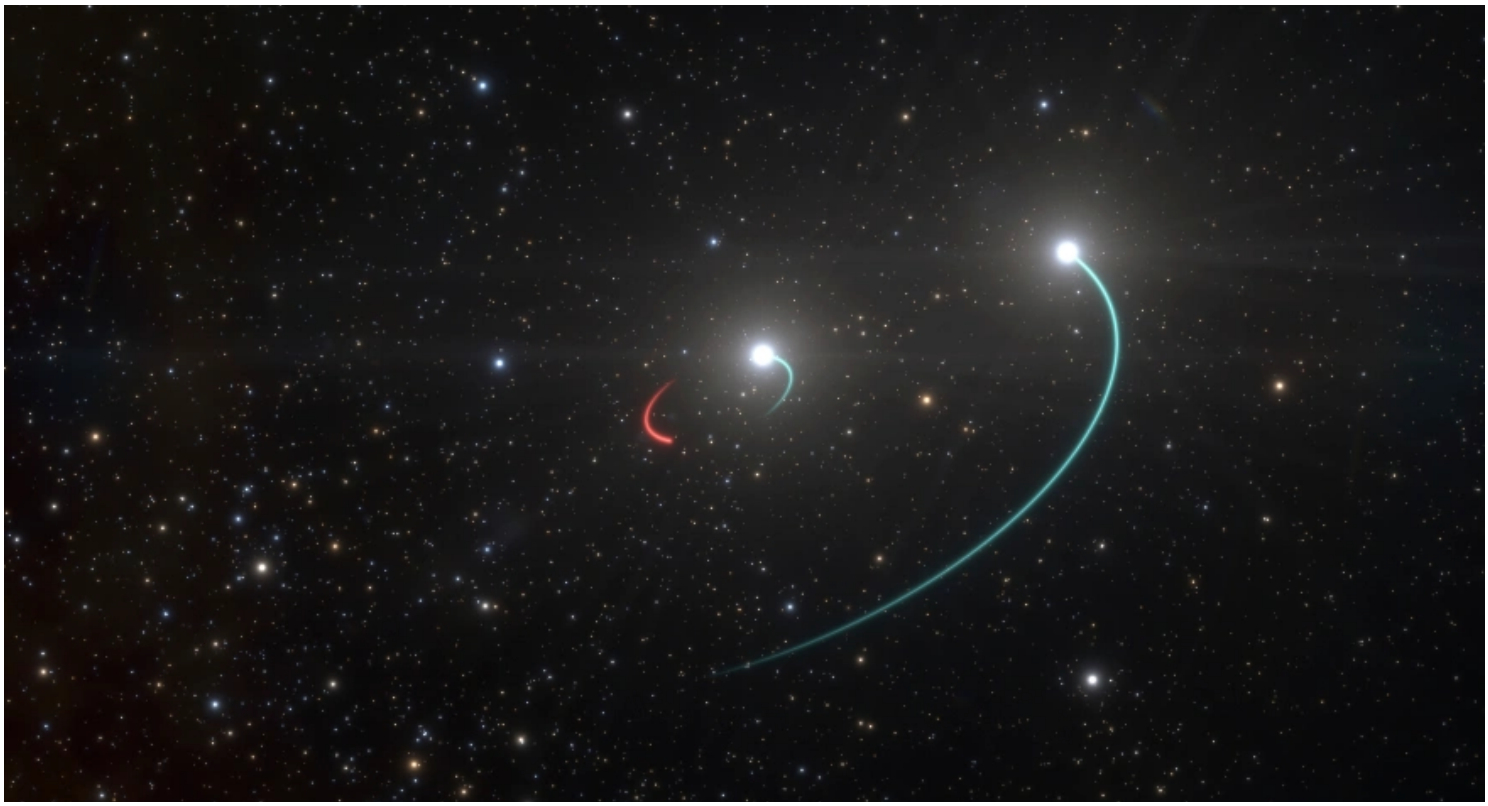
DIGITAL EXCLUSIVES

Rethinking black holes: New theory says that something that goes into one won’t be gone for good



This illustration provided by the European Southern Observatory in May 2020 shows the orbits of the objects in the HR 6819 triple system. The group is made up of an inner binary with one star, orbit in blue, and a newly discovered black hole, orbit in red, as well as a third star in a wider orbit, blue. The team originally believed there were only two objects, the two stars, in the system. However, as they analysed their observations, they revealed a third, previously undiscovered body in HR 6819: a black hole, the closest ever found to Earth, about 1000 light years away. The black hole is invisible, but it makes its presence known by its gravitational pull, which forces the luminous inner star into an orbit. The objects in this inner pair have roughly the same mass and circular orbits. (L. Calçada/ESO via AP)

by: Dan Gross

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ROCHESTER, N.Y. (WROC) — One of the universe’s most intriguing mysteries is the black hole. Now, one of its mysteries might be unraveling.

story regarding a Nobel Prize win for work on the "supermassive black hole" in the center of our galaxy, Don Figer.

In the most simplest of terms, a black hole occurs when some of the biggest stars die , and it loses the energy maintain its outermost layer. Its mass collapses down into a single point, called a singularity. The force of gravity is so strong in a black hole that nothing could escape it.

"Not even light can escape, which is why its black, it's as simple as that," said Figer. "When you have that much matter in such a small thing, it's very strong."

Now, to the new stuff.

According to Quanta Magazine, a group of scientists challenged a key paradox in Stephen Hawking's theory on black holes, that not even information could escape a black hole, and may have concluded that information can escape a black hole.

Not that this challenge is exactly new; one of Hawking's graduate students, Don Page, made a one dollar bet with Hawking that this paradox wasn't true.

Page would eventually win out.

"It's the dream of every graduate student, I would bet," Figer said.

I would venture to say that this is the hardest earned dollar I can think of.

Page's interpretation of the "picture" — a term Figer uses to combine all of the concepts and math in a theory — would eventually prove to be more true.

"Losing information" is an ephemeral concept to say the least, and Figer broke it down for me — and by extension, you — like this:

"Hawking claimed that the information represented by anything that fell into the black hole would be erased, and you could never get it out," he said. "The paradox is

Figer then said that the team of scientists figured out “the trick” to solving this paradox: just assume that information can never be lost, and work to make that assumption apply.

“People have made fundamental advances by assuming one simple thing had to be true, and you can conceive of everything else to make that true,” he said.

That isn’t to say that nothing would happen to this “information” when it went through a black hole.

Figer details a relatable scenario — I know the term “relatable” is pretty relative in this story — of a hard drive that was smashed into millions of pieces.

But the *information* hasn’t been destroyed. Rather, an incredible amount of entropy, or randomness, has been introduced to the information. It’s not that someone couldn’t put back together, but it would take an insurmountable amount of time and energy.

The difference between our hard drive example and a black hole is that if something went into a black hole, it would take a *very*, *very*, *very* long time for it to come back around, even if you could put something back together.

“Hawking wrote a paper in 1975 where he conceived of a notion that there are virtual particles just outside the event horizon, the place where light can no longer escape,” he said. “These particles are created out of the vacuum in pairs, and they usually are created and come back together, and nothing happens… You don’t notice them, they go into existence and back out of existence.

“If a pair of particles are created, and before they can come back together, one gets ripped off and is sucked into a black hole… Now that’s a little bit weird.”

You don’t say, Dr. Figer.

He goes on to say that this process creates “Hawking radiation,” which he says is so small that we can’t even begin to conceive of how to measure it.

Despite that, this is assumed to happen.

Now, this decay takes a long time.

“A star as massive as our sun would take 10 to the 80th power years to decay,” he says.

This is many, many, many times older than our universe, which is measured at 13 billion years old.

Needless to say, we may never be actually able to test this.

Figer went on to say that this experiment used “a daisy-chain of Rube Goldberg devices to show it’s possible,” but says that the scientists probably couldn’t answer. But he says this is how science works; you create the incomplete scaffolding, then you can fill it in over time.

Which led to this question I had to ask:

“So why is this even important to the human condition?”

“The number of people who do this number in the hundreds, at most,” he said. “But it turns out, more people than that are interested in this, people like you. I flip this upside down and ask, ‘why in the world would you be interested in this?’ It turns out it’s not just you, it’s all sorts of people.

“They’re interested in things that are happening in 10^80 years, it doesn’t make any sense. Animals don’t have interest in this. They just get food, sleep, and reproduce. Humans have some other thing where they think about things in the future. They

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Well, there you have it. I enjoyed talking about this, and I hope you got something out of this.

I also think Figer has earned a free plug, at the very least for dealing with me.

He's giving a public talk next week on optics Tuesday at 7pm over Zoom. You can register through OSA Rochester here.

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