Name: _____ Date: _____

The First Picture of a Black Hole

Reading level 11 (7th grade) · 873 words

A black hole is a place where gravity is so strong that nothing can get out of it, not even light. That means there is nothing for a camera to catch. So how do you take a picture of one? In April of 2019, a team of more than two hundred scientists from around the world showed the answer. It was a bright, fuzzy ring around a dark middle, and it was the first picture of a black hole that anyone had ever seen.

The black hole in the picture sits in the middle of a faraway galaxy called Messier 87, or M87, which is fifty-five million light-years from Earth. It is huge. But it is so far away that the ring in the picture looks about as small to us as a doughnut would, lying on the Moon. And this is not a snapshot like the ones on a phone. The telescopes picked up radio waves, and computers turned them into a picture.

The black hole itself stays dark. What shows up is the glow around it. Glowing gas swirls around a black hole. The black hole’s gravity bends that light into a bright ring, and in the middle is a dark patch, a shadow, like a stone held up in front of a lamp. Einstein’s equations said a black hole should cast one. If the scientists could photograph the shadow, they would be as close as anyone can get to seeing a black hole.

There was a problem. To see something so small and so far away, a single telescope would have to be far bigger than any that people can build. So the scientists tried something clever, a plan first dreamed up in the early 2000s. They tied together eight radio telescopes on mountaintops and in deserts, in Hawaii, in Spain, in Chile and at the bottom of the world in Antarctica. Working together in step, the eight acted like one telescope as big as the Earth.

Then they had to wait for the weather. Every one of the eight telescopes needed clear skies at the very same time, and that is rare. After studying the weather forecasts, the scientists picked four nights in the spring of 2017, and on the fifth of April the telescopes began to look at M87 together. All across the planet, every one of them was aimed at the same dark spot in the sky. One cloudy mountain would have spoiled it for everyone.

Each telescope wrote down what it heard on stacks of hard drives. Sending that much over the internet would have taken far longer, so people packed the drives in boxes and put them on planes. They flew to two buildings, one in Massachusetts and one in Germany. A clock at each telescope had stamped the time on every bit. That way, supercomputers could line up the streams, find the signal the telescopes shared, and separate out the static that belonged to only one of them.

After all that, nobody just handed over the picture. The scientists split into four teams, and each team got the same data and made an image on its own, without peeking at the others.

Each team used its own methods to turn the radio waves into an image. That was the whole point of working apart. A picture that only one person could make would not be worth much. If all four teams, working alone, drew the same thing, then it was not one person's mistake. It was really there.

One of the scientists, Kazunori Akiyama, did not sleep the night before the data was released to the teams. He remembered what happened when his team's first image appeared. It was a little messy, but there was a ring, a glowing ring, and he was delighted. Then he was anxious. What if he was the only one who had seen it? Soon after, the four teams met at Harvard University and laid out their pictures. All four had made the same lopsided ring. There was cheering, and there was applause, and enormous relief.

The ring is brighter on one side than on the other. The gas there is racing toward us as it spins around, and gas that is racing toward you looks brighter. The speed is close to the speed of light. So the picture shows more than a hole. It shows a black hole in motion, just as Einstein's equations had said it would look. From the pictures, the scientists worked out that this black hole is about six and a half billion times as heavy as our Sun.

The glow around the black hole in M87 does not sit still. At this sharpness, the scientists found that it changes from one day to the next. One of them said the picture was like the first frame of a movie. Someday there may be a whole movie of a black hole. The team has already grown from eight telescopes to at least eleven, to make sharper pictures. In 2022 it showed a second one, of the black hole at the center of our own galaxy. But this ring, blurry and far away, is the first, and it showed that a picture could be made.

Questions

1. Why can a camera not take a picture of a black hole itself?

A. Nothing, not even light, gets out of it
B. It is too close
C. It moves too fast to catch

2. Why did the scientists link eight telescopes together?

A. To make one telescope as big as the Earth
B. Because one was broken
C. So each could sleep

3. How did the data get from the telescopes to the supercomputers?

A. It was flown there on hard drives
B. It was texted
C. It was sent by mail in a bottle

4. Why did four teams make the image without looking at each other’s work?

A. So that matching results would show the ring was real

B. So they could win a prize

C. So that nobody would finish early

5. In this story, what is a “shadow” of a black hole?

A. The dark patch in the middle of the glowing gas

B. A small cloud

C. A reflection of the Sun

6. Why is the ring brighter on one side?

A. Gas on that side is racing toward us

B. That side is closer to the Moon

C. Someone colored it in

Words to know

galaxy: star city

telescope: far-seeing tool

gravity: pulling force

shadow: dark patch

signal: message, sign

Answer key: The First Picture of a Black Hole

1. A. Nothing, not even light, gets out of it
2. A. To make one telescope as big as the Earth
3. A. It was flown there on hard drives
4. A. So that matching results would show the ring was real
5. A. The dark patch in the middle of the glowing gas
6. A. Gas on that side is racing toward us