Do you remember that time...

So yummy.

we made observations together with many other telescopes around the globe?

Yes, it was tough.

Nice doughnuts!!

We got the first image of a black hole!

We did it!

Wow! It’s awesome!

You’ve heard a lot about black holes before?

Well, yes. But we had never obtained an image of a black hole before.

Hey, don’t eat our black hole picture!

First Image of a Black Hole
In 1915, the legendary scientist Albert Einstein established the theory of general relativity. In 1916, a physicist Karl Schwarzschild found a weird but interesting solution to Einstein’s equation. His solution shows that it is theoretically possible for something to have such strong gravity that...

Even light cannot escape. It is something like a bottomless hole in the Universe. Now we call this...

A “BLACK HOLE.”
... this is only the first try, but it could enhance the capability of our radio telescope.

Hey, we are ready in Europe!

We're ready in the US.

OK, let’s start observations in unison.

Well done!

It looks like we succeeded.

Yeah, then how about extending the array further?
In 1985...

We'll help with our Nobeyama 45 m telescope!

Welcome, Japan!

We succeeded in making transatlantic observations, so the next step is to go global.

Japan

Nobeyama 45 m Telescope

Let's include an Asian telescope to enhance the telescope power.

Good!

We now have new telescopes too.

We got even higher resolution!

The future of this project is really promising.

Hey, we can go much further!

What?
Our goal is a ... BLACK HOLE!

Cool!

Certainly we still need many things: more telescopes and shorter wavelengths ... But it is not impossible!

Future generations of scientists can surely do it!

—in 2011—

We have many telescopes with better sensitivity.

We are almost ready ... to take the very first image of a ... BLACK HOLE!

Dr. Shep Doeleman
Finally!

Wait, even light cannot escape from a black hole. How can we take an image of such an invisible hole?

Good question! But there is no problem.

There should be a disk of hot gas around a black hole.

Aha, then the disk will emit radio waves.

Right! So using an extremely high resolution telescope we can take a picture of the ring.

The hole in the center is the “shadow” of a black hole!

We are developing analytical and numerical simulations to predict the flow of matter around the black hole.

The models show different types of disks and jets. But they all have a hole of some kind.

We are also studying how the gravity of the black hole bends light and distorts the image.
The target is the supermassive black hole in the center of the galaxy M87.

The black hole is pretty massive, so the central “hole” in the image should be big enough ...

... to capture with our network of telescopes.

Yes. Many telescopes in various locations joined our project to make an Earth-sized virtual telescope.

The JCMT and SMA in Hawai‘i

IRAM 30 m in Spain

LMT in Mexico

SMT in Arizona

APEX in Chile

South Pole Telescope in Antarctica

And the brandnew ALMA in Chile.

It is not an easy job coordinating all the telescopes.
We have to transport the huge data contained in hard disk drives by air. The data could be as large as several thousand tera-bytes. And it takes many months to process all the data to obtain an image. We have many things to overcome. But, it is worth it!

It is our dream to take a real photo of a black hole and .... it will be a giant leap for mankind, not only in astronomy.

Yes, we got the image, but this is just the beginning. —In 2019—

Hey guys!

Right! We can do more!