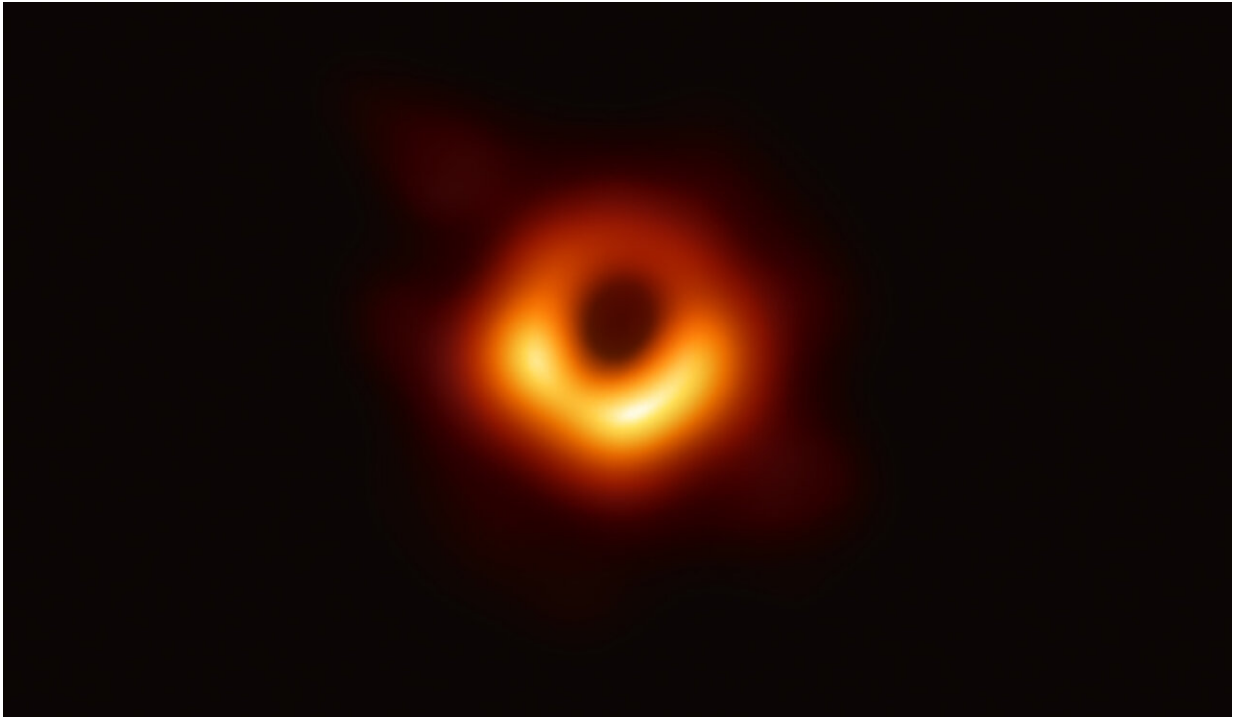


# Astronomers deliver first photo of black hole

April 10 2019

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Credit: NSF

Astronomers on Wednesday unveiled the first photo of a black hole, one of the star-devouring monsters scattered throughout the Universe and obscured by impenetrable shields of gravity.

The image of a dark core encircled by a flame-orange halo of white-hot plasma looks like any number of artists' renderings over the last 30 years.

But this time, it's the real deal.

"The history of science will be divided into the time before the image, and the time after the image," said Michael Kramer, director at the Max Planck Institute for Radio Astronomy.

Carlos Moedas, European Commissioner for Research, Science and Innovation called the feat a "huge breakthrough for humanity."

The supermassive black hole immortalised by a far-flung network of radio telescopes is 50 million lightyears away at the centre of a galaxy known as M87.

"It's a distance that we could have barely imagined," Frederic Gueth, an astronomer at France's National Centre for Scientific Research (CNRS) and co-author of studies detailing the findings, told AFP.

Most speculation had centred on the other candidate targeted by the Event Horizon Telescope: Sagittarius A\*, a closer but smaller black hole at the centre of our own galaxy, the Milky Way.

Locking down an image of M87's supermassive black hole at such distance is comparable to photographing a pebble on the Moon, the scientists said.

It was also very much a team effort.

"Instead of constructing a giant telescope that would collapse under its own weight, we combined many observatories," Michael Bremer, an astronomer at the Institute for Millimetric Radio Astronomy (IRAM) in Grenoble, told AFP.

## **Earth in a thimble**

Over several days in April 2017, eight radio telescopes in Hawaii, Arizona, Spain, Mexico, Chile, and the South Pole zeroed in on Sag A\* and M87.

Knitted together, they formed a virtual observatory some 12,000 kilometres across—roughly the diameter of Earth.

"The data is like an incomplete puzzle set," said team member Monika Moscibrodzka, an astronomer at Radboud University. "We only see pieces of the real true image, and then we have to fill in the gaps of the missing pieces."

In the end, M87 was more photogenic. Like a fidgety child, Sag A\* was too "active" to capture a clear picture, the scientists said.

"What we see in the image is the shadow of the black hole's rim—known as the event horizon, or the point of no return—set against the luminous accretion disk," Gueth told AFP.

The unprecedented image—so often imagined in science and science fiction — has been analysed in six studies co-authored by 200 experts from 60-odd institutions and published Wednesday in *Astrophysical Journal Letters*.

"I never thought that I would see a real one in my lifetime," said CNRS astrophysicist Jean-Pierre Luminet, author in 1979 of the first digital simulation of a black hole.

Coined in the mid-60s by US physicist John Archibald Wheeler, the term "black hole" refers to a point in space where matter is so compressed as to create a gravity field from which even light cannot escape.

The more mass, the bigger the hole. At the same scale of compression, Earth would fit inside a thimble.

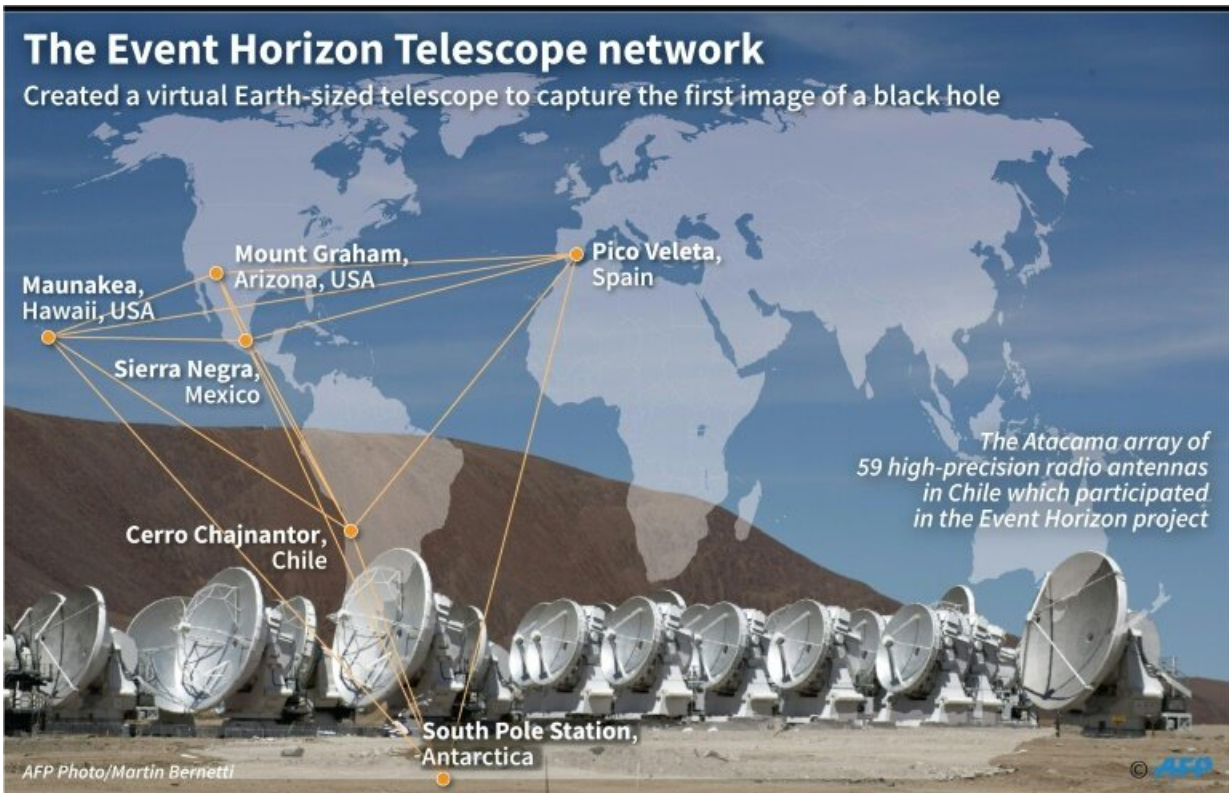
A successful outcome depended in part on the vagaries of weather during the April 2017 observation period.

"For everything to work, we needed to have clear visibility at every (telescope) location worldwide", said IRAM scientist Pablo Torne, recalling collective tension, fatigue and, finally, relief.

## **'Hell of a Christmas present'**

Torne was at the controls of the Pico Veleta telescope in Spain's Sierra Madre mountains.

After that, it was eight months of nail-biting while scientists at MIT Haystack Observatory in Massachusetts and the Max Planck Institute for Radio Astronomy in Bonn crunched the data.



The Event Horizon Telescope—a network of eight radio telescopes across the globe—gathered data to generate the first image of a black hole some 50 million lightyears from Earth

The Universe is filled with electromagnetic "noise", and there was no guarantee M87's faint signals could be extracted from a mountain of data so voluminous it could not be delivered via the Internet.

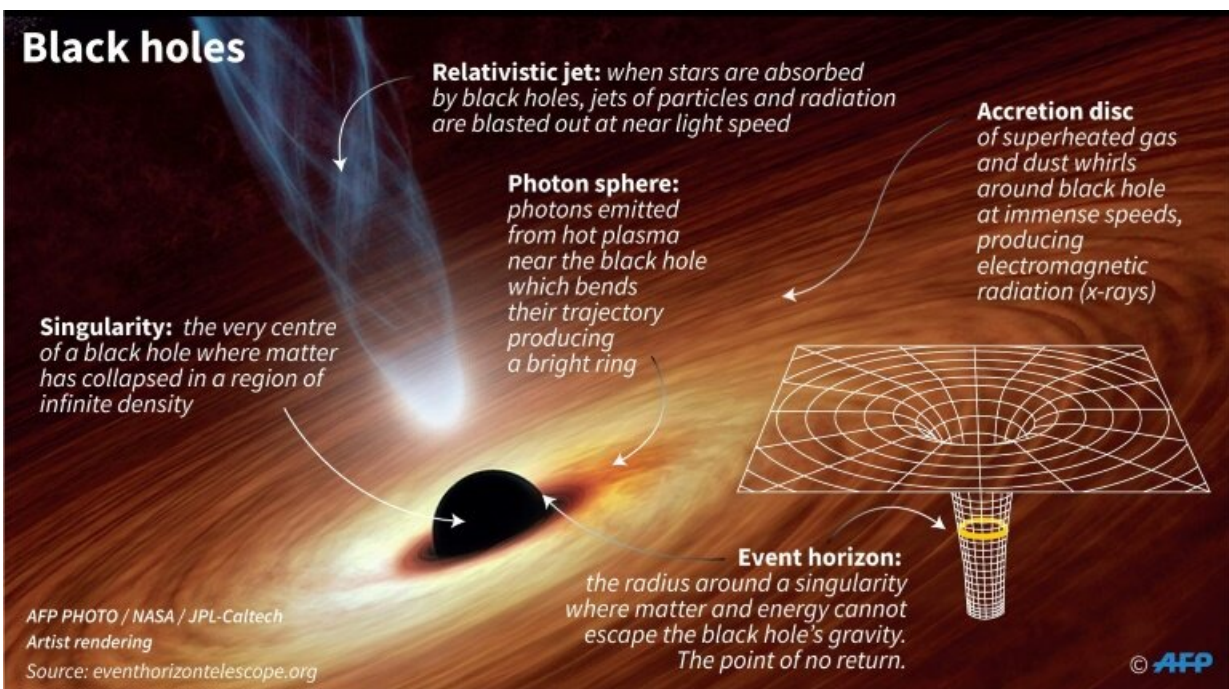
There was at least one glitch.

"We were desperately waiting for the data from the South Pole Telescope, which—due to extreme weather conditions during the southern hemisphere winter—didn't arrive until six months later," recalled Helger Rottmann from the Max Planck Institute.

It arrived, to be precise, on December 23, 2017.

"When, a few hours later, we saw that everything was there, it was one hell of a Christmas present," Rottmann said.

It would take another year, however, to piece together the data into an image.



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"To be absolutely sure, we did the work four times with four different teams," said Gueth.



Team scientists presenting the findings at a news conference in Brussels were visibly moved.

"We are looking at a region we have never looked at before, that we cannot really imagine being there," said Heino Falcke, chair of the EHT Science Council.

"It feels like looking at the gates of hell, at the end of space and time -- the event horizon, the point of no return."

**More information: PAPERS:**

- [Paper I: The Shadow of the Supermassive Black Hole](#)
- [Paper II: Array and Instrumentation](#)
- [Paper III: Data processing and Calibration](#)
- [Paper IV: Imaging the Central Supermassive Black Hole](#)
- [Paper V: Physical Origin of the Asymmetric Ring](#)
- [Paper VI: The Shadow and Mass of the Central Black Hole](#)

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