1
00:00:00,980 --> 00:00:04,080
For the first time ever, scientists using NASA's

2
00:00:04,080 --> 00:00:08,860
Fermi Gamma-ray Space Telescope have found the source of a high-energy neutrino

3
00:00:08,860 --> 00:00:12,380
from outside our galaxy. The neutrino came from the

4
00:00:12,380 --> 00:00:16,160
eruption of a supermassive black hole at the center of a type of galaxy called

5
00:00:16,160 --> 00:00:20,620
a blazar. The eruption jetted out particles moving near the speed of light.

6
00:00:22,580 --> 00:00:24,500
Collisions inside the jet produced

7
00:00:24,500 --> 00:00:28,400
gamma rays, the highest-energy form of light, and neutrinos,

8
00:00:28,400 --> 00:00:30,900
ghostly particles that rarely interact with matter.

9
00:00:32,200 --> 00:00:36,340
3.7 billion years later, they reached Earth.

10
00:00:37,360 --> 00:00:41,120
On September 22, 2017, a single

11
00:00:41,120 --> 00:00:45,300
high-energy neutrino struck an atom in a water molecule in the Antarctic ice.

12
00:00:45,300 --> 00:00:48,260
The crash produced a particle called a muon.

13
00:00:49,080 --> 00:00:52,800

It raced through the ice so fast it emitted a faint blue glow.

14
00:00:54,220 --> 00:00:57,620
When the muon reached the South Pole, it was tracked by the

15
00:00:57,630 --> 00:01:01,680
IceCube Neutrino Observatory. IceCube scientists found

16
00:01:01,680 --> 00:01:04,520
the original neutrino likely came from beyond our solar system.

17
00:01:05,320 --> 00:01:09,900
They alerted astronomers to be on the lookout for cosmic outbursts possibly

18
00:01:09,910 --> 00:01:14,100
associated with it. NASA's Fermi Gamma-ray Space

19
00:01:14,100 --> 00:01:17,760
Telescope found the source, a blazar it had been watching for some time.

20
00:01:19,540 --> 00:01:22,240
When the neutrino arrived, Fermi saw the blazar

21
00:01:22,240 --> 00:01:24,700
was brighter than it had been over the previous decade.

22
00:01:25,740 --> 00:01:29,940
It's the first time a neutrino could be traced back to a black hole, or to any

23
00:01:29,940 --> 00:01:34,000
source beyond our immediate galactic neighborhood. And it's an important

24
00:01:34,180 --> 00:01:38,260
step forward for a growing field scientists call multimessenger astronomy,

25
00:01:38,860 --> 00:01:42,560
which combines light with new signals like gravitational waves

26
00:01:42,560 --> 00:01:46,360
and neutrinos, to provide new insights on the most

27
00:01:46,360 --> 00:01:50,400
extreme cosmic phenomena.

28
00:01:50,800 --> 00:01:54,880
[Music fades] NASA Astrophysics