1
00:00:16,180 --> 00:00:04,020
[Music]

2
00:00:16,200 --> 00:00:20,220
Narrator: Parkes 1441+25 is a distant

3
00:00:20,240 --> 00:00:24,270
galaxy powered by a supermassive black hole. It's so far away

4
00:00:24,290 --> 00:00:28,290
its light takes more than half the current age of the universe to reach us.

5
00:00:28,310 --> 00:00:32,370
This is NASA's Fermi Gamma-ray Space Telescope,

6
00:00:32,390 --> 00:00:36,450
our sharpest satellite eyes on the gamma-ray sky. But Fermi's

7
00:00:36,470 --> 00:00:40,510
effective collecting area is about the size of two office desks. It can't

8
00:00:40,530 --> 00:00:44,540
catch everything. Ground-based gamma-ray observatories sport

9
00:00:44,560 --> 00:00:48,570
much larger light collectors than Fermi, but like traditional telescopes, they

10
00:00:48,590 --> 00:00:52,590
only work at night. Both MAGIC and VERITAS work

11
00:00:52,610 --> 00:00:56,650
by catching faint flashes of visible light produced when a high-energy

12
00:00:56,670 --> 00:01:00,700
gamma ray strikes the upper atmosphere. This creates a shower

13
00:01:00,720 --> 00:01:04,740

of fast-moving charged particles that emit a glow called Cerenkov radiation.

14
00:01:04,760 --> 00:01:08,760
On April 16, 2015,

15
00:01:08,780 --> 00:01:12,810
Parkes 1441 was exhibiting high activity across all wavelengths.

16
00:01:12,830 --> 00:01:16,830
Scientists looking at Fermi data reported a strong gamma-ray

17
00:01:16,850 --> 00:01:20,840
outburst. Based on this alert, scientists on the MAGIC team began

18
00:01:20,860 --> 00:01:24,890
monitoring the galaxy and detected very-high-energy gamma rays.

19
00:01:24,910 --> 00:01:28,960
That was the cue for VERITAS to take a look, and it also captured the

20
00:01:28,980 --> 00:01:32,990
quasar's very-high-energy emission. These detections were

21
00:01:33,010 --> 00:01:37,020
remarkable because high-energy light usually can't travel extreme distances

22
00:01:37,040 --> 00:01:41,070
These gamma rays had been traveling for half the age of the cosmos

23
00:01:41,090 --> 00:01:45,120
passing through all the light emitted by stars, supernovae, and everything else

24
00:01:45,140 --> 00:01:49,140
that flashed and glowed across more than 7 billion years of cosmic history.

25
00:01:49,160 --> 00:01:53,170
Astronomers call this remnant glow is called the extragalactic background light

26
00:01:53,190 --> 00:01:57,210
background light. When a gamma ray strikes this lower-energy light, it converts into

27
00:01:57,230 --> 00:02:01,230
a pair of particles, an electron and a positron. The farther

28
00:02:01,250 --> 00:02:05,270
gamma rays travel the more likely it is they'll undergo this process, which effectively

29
00:02:05,290 --> 00:02:09,300
erases the gamma rays from the universe before we have the opportunity to detect

30
00:02:09,320 --> 00:02:13,370
them. Parkes 1441 is one of the most

31
00:02:13,390 --> 00:02:17,450
distant sources of gamma rays with energies above 100 GeV,

32
00:02:17,470 --> 00:02:21,490
tens of billions of times the energy in visible light. That the light

33
00:02:21,510 --> 00:02:25,530
reached us at all provides information about the extragalactic background light

34
00:02:25,550 --> 00:02:29,580
when the universe was half its present age. Those gamma rays

35
00:02:29,600 --> 00:02:33,730
originated from the particle jet produced by the galaxy's supermassive black hole.

36
00:02:33,750 --> 00:02:37,890
Astronomers think they started their journey only about 5 light-years from the

37
00:02:37,910 --> 00:02:41,960
black hole. Escaping the galaxy's crowded central regions

38
00:02:41,980 --> 00:02:46,050

means this high-energy light never interacted with matter or starlight, collisions

39
00:02:46,070 --> 00:02:50,120
that would have doomed them to convert into particles. This is one reason

40
00:02:50,140 --> 00:02:54,180
why extremely energetic gamma rays are few and far between, and why astronomers

41
00:02:54,200 --> 00:02:58,250
prize the relatively few photons they can find.

42
00:02:58,270 --> 00:03:02,270
The story of gamma rays from Parkes 1441 isn't a mere tale of survival.

43
00:03:02,290 --> 00:03:06,340
These photons executed a jailbreak of cosmic proportions,

44
00:03:06,360 --> 00:03:10,370
and it took Fermi, MAGIC, and VERTIAS to round them up.