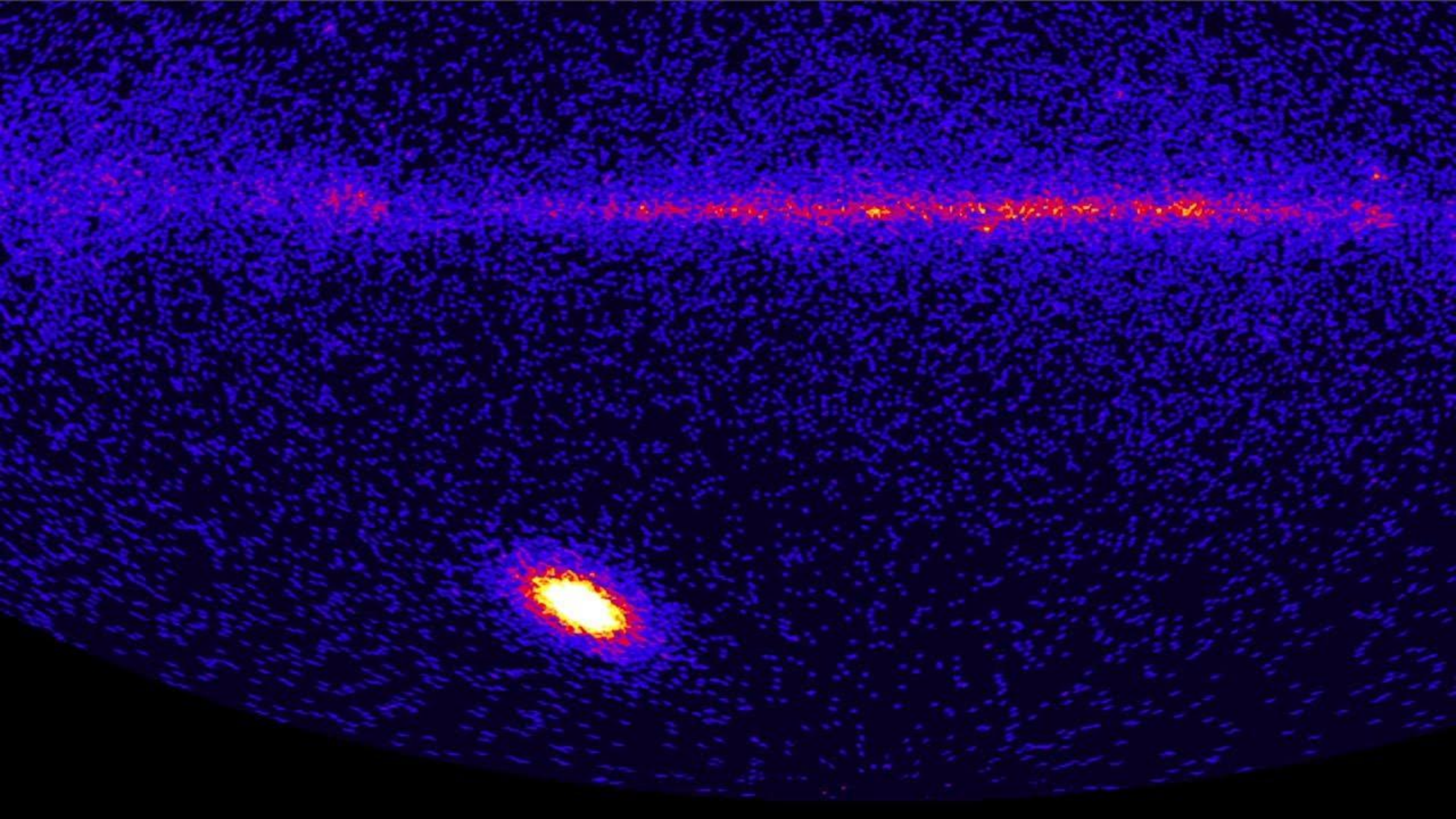

1
00:00:11,120 --> 00:00:07,030
Music

2
00:00:11,140 --> 00:00:15,210
Narrator: In early March, 2012, a powerful X 5.4

3
00:00:15,230 --> 00:00:19,240
flare erupted on the sun. The blast was observed by the fleet of spacecraft

4
00:00:19,260 --> 00:00:23,270
dedicated to monitoring our star...plus one unlikely addition:

5
00:00:23,290 --> 00:00:27,330
NASA's Fermi Gamma-ray Space Telescope.

6
00:00:27,350 --> 00:00:31,370
For Fermi, which detects high-energy gamma rays, the sun is almost never

7
00:00:31,390 --> 00:00:35,400
the brightest steady source in the sky. That distinction is reserved for the

8
00:00:35,420 --> 00:00:39,440
Vela pulsar. But on March 7, the sun outshone

9
00:00:39,460 --> 00:00:43,470
everything else Fermi could see. Thanks to the big flare, the sun had become

10
00:00:43,490 --> 00:00:47,500
the brightest object in the gamma-ray sky. Due to the keen angular

11
00:00:47,520 --> 00:00:51,530
resolution of Fermi's Large Area Telescope, for the first time scientists were

12
00:00:51,550 --> 00:00:55,570
able to narrow down the position of the high-energy gamma-ray emission to a part of the

13
00:00:55,590 --> 00:00:59,610

sun's disk. This gives scientists greater confidence that the gamma rays

14
00:00:59,630 --> 00:01:03,650
come from the same region as the solar flare seen in other wavelengths.

15
00:01:03,670 --> 00:01:07,790
During this event, the LAT detected the highest-energy light ever recorded

16
00:01:07,810 --> 00:01:11,860
from a solar flare. The gamma-rays peaked at 4 billion electron

17
00:01:11,880 --> 00:01:15,960
volts, or 2 billion times the energy of visible light. With

18
00:01:15,980 --> 00:01:20,040
Fermi recording high-energy gamma-ray emission for 20 hours after the event,

19
00:01:20,060 --> 00:01:24,060
the March 7th flare also set a duration record.

20
00:01:24,080 --> 00:01:28,100
Several mechanisms are behind this gamma-ray activity. Flares are thought

21
00:01:28,120 --> 00:01:32,120
to arise when strong magnetic fields undergo a process called "reconnection" and

22
00:01:32,140 --> 00:01:36,180
release pent-up energy. A sudden blast accelerates charged particles,

23
00:01:36,200 --> 00:01:40,210
some of which leave the sun, while others are driven toward it's visible surface.

24
00:01:40,230 --> 00:01:44,250
Many of these accelerated particles are

25
00:01:44,270 --> 00:01:48,270
protons. When they collide with gas in the sun's

26
00:01:48,290 --> 00:01:52,320
atmosphere or surface, the interaction creates a particle called a pion,

27
00:01:52,340 --> 00:01:56,370
which quickly decays into two gamma rays.

28
00:01:56,390 --> 00:02:00,410
These observations herald Fermi's arrival as a solar observatory,

29
00:02:00,430 --> 00:02:04,470
a powerful new tool for understanding the sun as it approaches its maximum