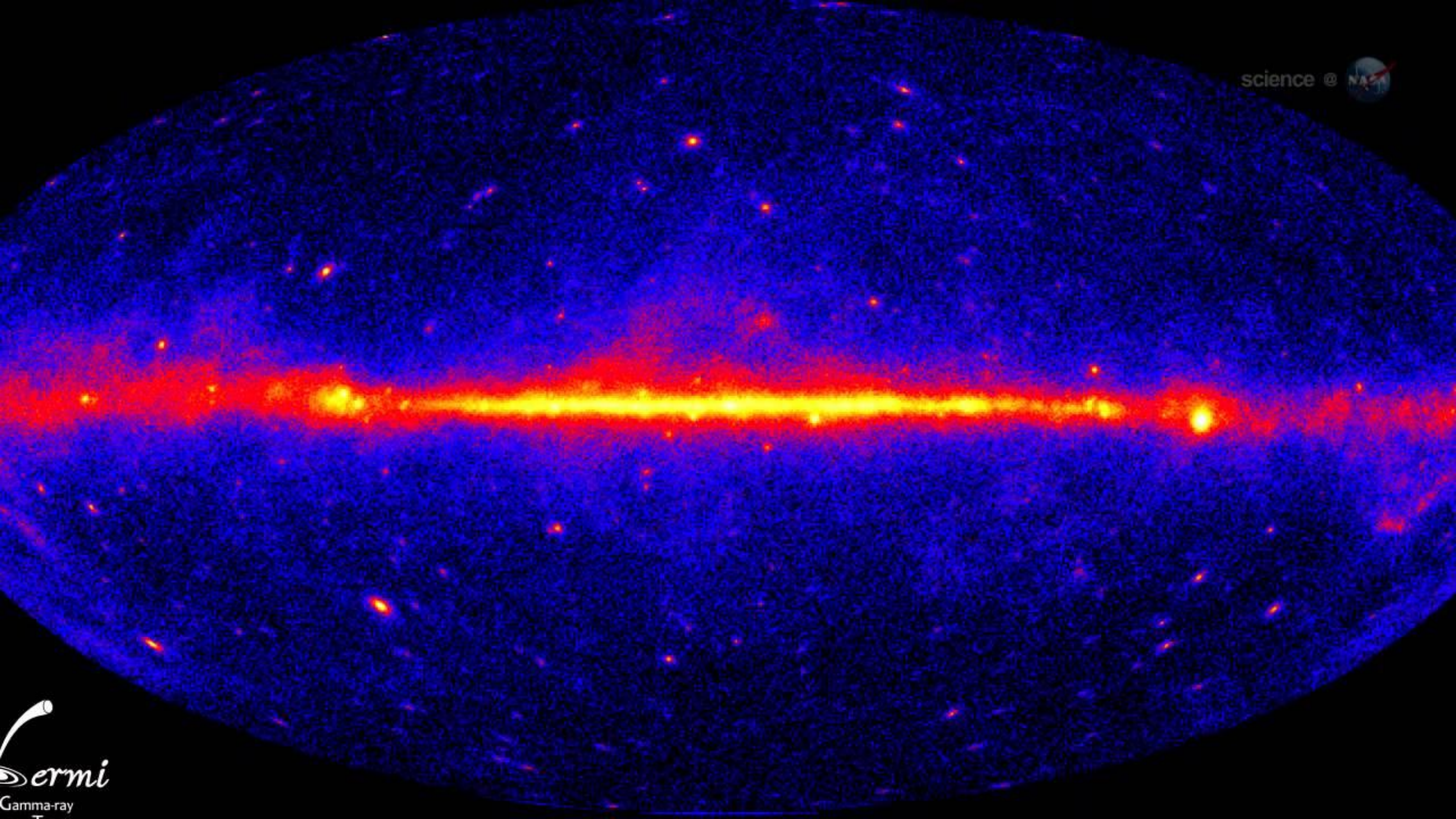
science @ NASA
Fermi
Gamma-ray

1
00:00:07,700 --> 00:00:04,999
mysterious objects at the edge of the

2
00:00:11,780 --> 00:00:07,710
electromagnetic spectrum presented by

3
00:00:14,270 --> 00:00:11,790
science at NASA the human eye is crucial

4
00:00:17,150 --> 00:00:14,280
to astronomy without the ability to see

5
00:00:19,130 --> 00:00:17,160
the luminous universe of stars planets

6
00:00:22,730 --> 00:00:19,140
and galaxies would be close to us

7
00:00:24,200 --> 00:00:22,740
unknown forever nevertheless astronomers

8
00:00:27,230 --> 00:00:24,210
can't shake their fascination with

9
00:00:28,609 --> 00:00:27,240
things they cannot see outside the realm

10
00:00:31,310 --> 00:00:28,619
of human vision is an entire

11
00:00:33,889 --> 00:00:31,320
electromagnetic spectrum of wonders each

12
00:00:36,049 --> 00:00:33,899
type of light from radio waves to gamma

13
00:00:38,780 --> 00:00:36,059

rays reveals something unique about the

14
00:00:41,090 --> 00:00:38,790
universe some wavelengths are best for

15
00:00:43,400 --> 00:00:41,100
studying black holes others reveal

16
00:00:45,110 --> 00:00:43,410
newborn stars and planets while others

17
00:00:48,650 --> 00:00:45,120
illuminate the earliest years of cosmic

18
00:00:50,180 --> 00:00:48,660
history nASA has many telescopes working

19
00:00:53,000 --> 00:00:50,190
the wavelengths up and down the

20
00:00:55,010 --> 00:00:53,010
electromagnetic spectrum one of them the

21
00:00:57,439 --> 00:00:55,020
fermi gamma-ray telescope orbiting Earth

22
00:00:59,840 --> 00:00:57,449
has just crossed a new electromagnetic

23
00:01:02,299 --> 00:00:59,850
frontier Fermi is picking up crazy

24
00:01:04,340 --> 00:01:02,309
energetic photons says Dave Thompson an

25
00:01:06,620 --> 00:01:04,350
astrophysicist at NASA's Goddard Space

26
00:01:08,420 --> 00:01:06,630
Flight Center and it's detecting so many

27
00:01:10,160 --> 00:01:08,430
of them we've been able to produce the

28
00:01:12,950 --> 00:01:10,170
first all-sky map of the very

29
00:01:14,660 --> 00:01:12,960
high-energy universe this is what the

30
00:01:17,090 --> 00:01:14,670
sky looks like near the very edge of the

31
00:01:19,570 --> 00:01:17,100
electromagnetic spectrum between 10

32
00:01:21,859 --> 00:01:19,580
billion and 100 billion electron volts

33
00:01:24,020 --> 00:01:21,869
the light we see with human eyes

34
00:01:26,840 --> 00:01:24,030
consists of photons with energies in the

35
00:01:29,120 --> 00:01:26,850
range two to three electron volts the

36
00:01:31,910 --> 00:01:29,130
gamma rays Fermi detects are billions of

37
00:01:34,539 --> 00:01:31,920
times more energetic from 20 million to

38
00:01:37,490 --> 00:01:34,549

more than 300 billion electron volts

39
00:01:39,530 --> 00:01:37,500
these gamma-ray photons are so energetic

40
00:01:41,830 --> 00:01:39,540
they cannot be guided by the mirrors and

41
00:01:44,960 --> 00:01:41,840
lenses found in ordinary telescopes

42
00:01:47,660 --> 00:01:44,970
instead Fermi uses a sensor that is more

43
00:01:49,580 --> 00:01:47,670
like a Geiger counter than a telescope

44
00:01:52,070 --> 00:01:49,590
if we could wear Fermi's gamma-ray

45
00:01:55,010 --> 00:01:52,080
glasses we'd witness powerful bullets of

46
00:01:56,840 --> 00:01:55,020
energy individual gamma rays from cosmic

47
00:01:59,690 --> 00:01:56,850
phenomena such as supermassive black

48
00:02:02,300 --> 00:01:59,700
holes and hypernova explosions the sky

49
00:02:04,249 --> 00:02:02,310
would be a frenzy of activity before

50
00:02:05,810 --> 00:02:04,259
Fermi was launched in june two thousand

51
00:02:07,850 --> 00:02:05,820
eight there were only four known

52
00:02:11,120 --> 00:02:07,860
celestial sources of photons in this

53
00:02:14,420 --> 00:02:11,130
energy range in three years Fermi has

54
00:02:17,390 --> 00:02:14,430
found almost 500 more says Thompson what

55
00:02:19,640 --> 00:02:17,400
lies within this new realm mystery for

56
00:02:21,470 --> 00:02:19,650
one thing says Thompson about a third of

57
00:02:23,330 --> 00:02:21,480
the new sources can't be clearly linked

58
00:02:25,699 --> 00:02:23,340
to any of the known types of objects

59
00:02:28,130 --> 00:02:25,709
that produce gamma rays we have no idea

60
00:02:31,610 --> 00:02:28,140
what they are the rest have one thing in

61
00:02:33,440 --> 00:02:31,620
common prodigious energy among them are

62
00:02:35,780 --> 00:02:33,450
supermassive black holes called blazars

63
00:02:38,360 --> 00:02:35,790

the ceiling remnants of supernova

64
00:02:41,479 --> 00:02:38,370
explosions and rapidly rotating neutron

65
00:02:43,280 --> 00:02:41,489
stars called pulsars and some of the

66
00:02:45,710 --> 00:02:43,290
gamma rays seem to come from the Fermi

67
00:02:47,809 --> 00:02:45,720
bubbles giant structures emanating from

68
00:02:50,090 --> 00:02:47,819
the Milky Way's Center and spanning some

69
00:02:52,670 --> 00:02:50,100
20,000 light-years above and below the

70
00:02:54,940 --> 00:02:52,680
Galactic plane exactly how these bubbles

71
00:02:56,640 --> 00:02:54,950
formed is another mystery

72
00:02:58,780 --> 00:02:56,650
now that the first sky map is complete

73
00:03:01,390 --> 00:02:58,790
Fermi is working on another more

74
00:03:03,339 --> 00:03:01,400
sensitive and detailed survey in the

75
00:03:05,320 --> 00:03:03,349
next few years Fermi should reveal

76
00:03:07,300 --> 00:03:05,330
something new about all these phenomena

77
00:03:09,160 --> 00:03:07,310
what makes them tick and why the

78
00:03:11,800 --> 00:03:09,170
generates such unearthly levels of

79
00:03:13,630 --> 00:03:11,810
energy says David panic a leader in this

80
00:03:16,390 --> 00:03:13,640
work from the Max Planck Institute in

81
00:03:18,460 --> 00:03:16,400
Germany for now though there are more

82
00:03:21,570 --> 00:03:18,470
unknowns than knowns about Fermi's world

83
00:03:24,520 --> 00:03:21,580
says Thompson it's pretty exciting for