1
00:00:09,430 --> 00:00:07,670
dark lightning presented by science at

2
00:00:14,629 --> 00:00:09,440
nasa

3
00:00:16,710 --> 00:00:14,639
was launched in 2008 on a mission to

4
00:00:19,429 --> 00:00:16,720
study high energy phenomena in our

5
00:00:21,670 --> 00:00:19,439
universe the telescope routinely detects

6
00:00:24,790 --> 00:00:21,680
things like flares powered by black

7
00:00:27,589 --> 00:00:24,800
holes in distant galaxies or outbursts

8
00:00:30,470 --> 00:00:27,599
from massive stars going supernova

9
00:00:32,470 --> 00:00:30,480
so in 2010 researchers were not

10
00:00:35,270 --> 00:00:32,480
surprised when the telescope was hit by

11
00:00:37,830 --> 00:00:35,280
a beam of high-energy positrons the

12
00:00:39,670 --> 00:00:37,840
antimatter equivalent of electrons

13
00:00:41,190 --> 00:00:39,680

that's the sort of thing fermi is out

14
00:00:43,270 --> 00:00:41,200
there looking for

15
00:00:45,830 --> 00:00:43,280
but they were surprised when they

16
00:00:47,910 --> 00:00:45,840
realized where the antimatter came from

17
00:00:50,389 --> 00:00:47,920
not from some black hole light years

18
00:00:53,510 --> 00:00:50,399
across the galaxy but rather from our

19
00:00:56,389 --> 00:00:53,520
own planet the source was a thunderstorm

20
00:00:58,229 --> 00:00:56,399
just three thousand miles away

21
00:01:00,709 --> 00:00:58,239
earth's magnetic field seems to have

22
00:01:03,590 --> 00:01:00,719
corralled about 100 trillion positrons

23
00:01:05,189 --> 00:01:03,600
from the storm into a tight beam and

24
00:01:07,750 --> 00:01:05,199
funneled them all the way to the

25
00:01:10,830 --> 00:01:07,760
spacecraft explains lightning expert

26
00:01:13,030 --> 00:01:10,840
joseph dwyer of the florida institute of

27
00:01:15,429 --> 00:01:13,040
technology something was producing

28
00:01:17,670 --> 00:01:15,439
antimatter above the clouds of earth and

29
00:01:19,190 --> 00:01:17,680
hurling it into space at nearly the

30
00:01:20,469 --> 00:01:19,200
speed of light

31
00:01:22,550 --> 00:01:20,479
but what

32
00:01:24,550 --> 00:01:22,560
dwyer and collaborators at the nasa

33
00:01:26,789 --> 00:01:24,560
marshall space flight center and the

34
00:01:28,230 --> 00:01:26,799
university of alabama believe they have

35
00:01:31,990 --> 00:01:28,240
figured it out

36
00:01:33,590 --> 00:01:32,000
the answer says dwyer is dark lightning

37
00:01:35,910 --> 00:01:33,600
dark lightning may sound like an

38
00:01:37,429 --> 00:01:35,920

oxymoron but there is growing evidence

39
00:01:39,670 --> 00:01:37,439
that it is real

40
00:01:42,310 --> 00:01:39,680
ordinary lightning happens when electric

41
00:01:44,149 --> 00:01:42,320
fields build up inside thunder clouds

42
00:01:46,550 --> 00:01:44,159
electrons rush from one part of the

43
00:01:48,149 --> 00:01:46,560
cloud to another to try to cancel out

44
00:01:50,310 --> 00:01:48,159
the growing voltage

45
00:01:52,870 --> 00:01:50,320
the flash of light we see traces the

46
00:01:56,149 --> 00:01:52,880
path of the charged particles which heat

47
00:01:58,630 --> 00:01:56,159
the air five times hotter than the sun

48
00:02:00,709 --> 00:01:58,640
if dwyer's ideas are correct dark

49
00:02:01,830 --> 00:02:00,719
lightning is a competitor of ordinary

50
00:02:03,590 --> 00:02:01,840
lightning

51
00:02:05,910 --> 00:02:03,600
it also tries to cancel out the

52
00:02:08,229 --> 00:02:05,920
thunderstorm's electric fields

53
00:02:09,669 --> 00:02:08,239
the process he says goes something like

54
00:02:11,910 --> 00:02:09,679
this

55
00:02:13,830 --> 00:02:11,920
under the right conditions electric

56
00:02:16,710 --> 00:02:13,840
fields in a thunderstorm can create a

57
00:02:19,110 --> 00:02:16,720
powerful avalanche of electrons shooting

58
00:02:21,910 --> 00:02:19,120
upwards nearly as fast as light

59
00:02:24,390 --> 00:02:21,920
the electrons collide with air molecules

60
00:02:26,070 --> 00:02:24,400
in turn producing gamma rays

61
00:02:27,750 --> 00:02:26,080
earth-orbiting spacecraft have been

62
00:02:29,949 --> 00:02:27,760
observing gamma-ray flashes from

63
00:02:31,670 --> 00:02:29,959

thunderstorms since at least to the

64
00:02:34,309 --> 00:02:31,680
mid-1990s

65
00:02:37,110 --> 00:02:34,319
next the gamma-ray energy transforms

66
00:02:38,790 --> 00:02:37,120
into a pair of particles an electron and

67
00:02:40,710 --> 00:02:38,800
a positron

68
00:02:43,430 --> 00:02:40,720
successive collisions between these

69
00:02:46,309 --> 00:02:43,440
particles and other air molecules create

70
00:02:48,550 --> 00:02:46,319
a new batch of positrons and electrons

71
00:02:50,869 --> 00:02:48,560
and the cycle repeats

72
00:02:53,350 --> 00:02:50,879
a continuous feedback loop forms like

73
00:02:55,910 --> 00:02:53,360
nuclear fission it's a natural

74
00:02:57,990 --> 00:02:55,920
self-generated self-sustained particle

75
00:03:00,070 --> 00:02:58,000
accelerator says dwyer

76
00:03:02,309 --> 00:03:00,080
once the feedback loop gets started he

77
00:03:04,710 --> 00:03:02,319
says it can discharge parts of a

78
00:03:07,030 --> 00:03:04,720
thundercloud as fast as lightning

79
00:03:09,430 --> 00:03:07,040
and because the cascading electrons and

80
00:03:11,830 --> 00:03:09,440
positrons generate more gamma rays than

81
00:03:14,949 --> 00:03:11,840
visible light the whole process is

82
00:03:16,710 --> 00:03:14,959
practically invisible to the human eye

83
00:03:18,790 --> 00:03:16,720
researchers once thought the gamma-ray

84
00:03:21,350 --> 00:03:18,800
flashes from thunderstorms were a weird

85
00:03:23,110 --> 00:03:21,360
byproduct of ordinary lightning

86
00:03:25,830 --> 00:03:23,120
now they are thinking it is a sign of

87
00:03:27,750 --> 00:03:25,840
dark lightning instead

88
00:03:29,750 --> 00:03:27,760

the gamma-ray burst monitor onboard

89
00:03:30,869 --> 00:03:29,760
fermi is excellent at catching these

90
00:03:32,710 --> 00:03:30,879
flashes

91
00:03:35,190 --> 00:03:32,720
at the american geophysical union

92
00:03:37,430 --> 00:03:35,200
meeting last month valerie kanatan of

93
00:03:39,509 --> 00:03:37,440
the university of alabama in huntsville

94
00:03:41,589 --> 00:03:39,519
explained how new data processing

95
00:03:44,070 --> 00:03:41,599
techniques have improved the burst

96
00:03:46,789 --> 00:03:44,080
monitor's performance even more in

97
00:03:49,350 --> 00:03:46,799
mid-2010 we began testing a mode which

98
00:03:52,229 --> 00:03:49,360
allows us to locate many faint gamma-ray

99
00:03:54,390 --> 00:03:52,239
flashes we had been missing she said

100
00:03:57,350 --> 00:03:54,400
now team members estimate fermi should

101
00:03:58,470 --> 00:03:57,360
be able to catch almost 1000 flashes a

102
00:04:01,190 --> 00:03:58,480
year

103
00:04:03,589 --> 00:04:01,200
with data like that researchers hope to

104
00:04:07,110 --> 00:04:03,599
shed new light on dark lightning and

105
00:04:09,509 --> 00:04:07,120
solve its mysteries once and for all

106
00:04:11,509 --> 00:04:09,519
for more news about dark and mysterious

107
00:04:12,830 --> 00:04:11,519
things in the skies of earth