



# **A BLACK HOLE'S MAGNETIC REVERSAL**

1  
00:00:08,629 --> 00:00:06,550  
at the end of 2017 a galaxy 236 million

2  
00:00:11,110 --> 00:00:08,639  
light years away began a rare and

3  
00:00:12,950 --> 00:00:11,120  
dramatic transformation

4  
00:00:14,310 --> 00:00:12,960  
it's an event astronomers are still

5  
00:00:16,470 --> 00:00:14,320  
puzzling over

6  
00:00:18,470 --> 00:00:16,480  
one set off by changes near its central

7  
00:00:20,470 --> 00:00:18,480  
black hole

8  
00:00:21,990 --> 00:00:20,480  
they first explained this as a tidal

9  
00:00:24,150 --> 00:00:22,000  
disruption event

10  
00:00:26,070 --> 00:00:24,160  
that's when a star wanders so close to a

11  
00:00:28,390 --> 00:00:26,080  
supermassive black hole that it's torn

12  
00:00:30,710 --> 00:00:28,400  
apart

13  
00:00:34,549 --> 00:00:30,720

a new study of observations spanning the

14

00:00:36,630 --> 00:00:34,559

entire event suggests a different cause

15

00:00:39,190 --> 00:00:36,640

the trigger may have been a flip in the

16

00:00:41,510 --> 00:00:39,200

magnetic field in the disk of material

17

00:00:43,190 --> 00:00:41,520

around the black hole

18

00:00:45,510 --> 00:00:43,200

the sun's magnetic field reverses

19

00:00:47,270 --> 00:00:45,520

polarity every 11 years

20

00:00:50,150 --> 00:00:47,280

on longer time scales even earth's

21

00:00:52,869 --> 00:00:50,160

magnetic field flips

22

00:00:54,709 --> 00:00:52,879

starting in december 2017 the galaxy

23

00:00:56,389 --> 00:00:54,719

began to brighten invisible and

24

00:00:57,990 --> 00:00:56,399

ultraviolet light

25

00:01:00,069 --> 00:00:58,000

the source of this brightening appeared

26

00:01:02,229 --> 00:01:00,079

to be the disc of material around the

27

00:01:03,140 --> 00:01:02,239

supermassive black hole at the galaxy's

28

00:01:05,109 --> 00:01:03,150

center

29

00:01:06,950 --> 00:01:05,119

[Music]

30

00:01:11,590 --> 00:01:06,960

it peaked three months later at nearly

31

00:01:15,510 --> 00:01:13,190

that's when regular monitoring with

32

00:01:18,390 --> 00:01:15,520

nasa's swift satellite began

33

00:01:20,390 --> 00:01:18,400

as the visible and uv brightened x-rays

34

00:01:23,429 --> 00:01:20,400

from the galaxy dimmed

35

00:01:26,710 --> 00:01:23,439

by august 2018 the higher energy x-rays

36

00:01:28,390 --> 00:01:26,720

had disappeared completely

37

00:01:30,310 --> 00:01:28,400

a few months later the high energy

38

00:01:32,469 --> 00:01:30,320

x-rays came back even brighter than

39

00:01:35,670 --> 00:01:32,479

before

40

00:01:37,350 --> 00:01:35,680

they returned to normal within a year

41

00:01:39,910 --> 00:01:37,360

these x-rays come from a cloud of

42

00:01:41,910 --> 00:01:39,920

super-hot particles near the black hole

43

00:01:44,550 --> 00:01:41,920

it's a feature called the corona which

44

00:01:46,789 --> 00:01:44,560

is formed by the strong magnetic field

45

00:01:49,749 --> 00:01:46,799

the lack of higher energy x-rays means

46

00:01:51,990 --> 00:01:49,759

that this structure was essentially gone

47

00:01:54,389 --> 00:01:52,000

based on observations from swift

48

00:01:56,709 --> 00:01:54,399

europa's xmm satellite and ground-based

49

00:01:59,749 --> 00:01:56,719

optical and radio telescopes here's what

50

00:02:04,149 --> 00:02:01,990

the visible and uv flare results when

51  
00:02:05,590 --> 00:02:04,159  
the flow of matter into the black hole

52  
00:02:07,510 --> 00:02:05,600  
increases

53  
00:02:09,669 --> 00:02:07,520  
this may have started when the magnetic

54  
00:02:11,750 --> 00:02:09,679  
field in the disk's outer regions began

55  
00:02:13,510 --> 00:02:11,760  
to flip

56  
00:02:17,110 --> 00:02:13,520  
the weakened magnetic field can no

57  
00:02:18,869 --> 00:02:17,120  
longer support the corona which vanishes

58  
00:02:21,670 --> 00:02:18,879  
the flipped magnetic field gains

59  
00:02:24,470 --> 00:02:21,680  
strength restoring the x-ray corona but

60  
00:02:26,470 --> 00:02:24,480  
the inward flow of matter is still high

61  
00:02:28,630 --> 00:02:26,480  
so this emission is stronger than it was

62  
00:02:30,949 --> 00:02:28,640  
before the flare

63  
00:02:32,949 --> 00:02:30,959

finally the corona and disc returned to

64

00:02:36,869 --> 00:02:32,959

their states before the flare

65

00:02:39,350 --> 00:02:36,879

now with a flipped magnetic field

66

00:02:41,430 --> 00:02:39,360

rapid changes in uv and visible light

67

00:02:44,470 --> 00:02:41,440

have only been observed in a few dozen

68

00:02:46,390 --> 00:02:44,480

active galaxies like this one

69

00:02:48,390 --> 00:02:46,400

but this is the first time x-rays have

70

00:02:51,110 --> 00:02:48,400

been seen to drop out as other

71

00:02:53,830 --> 00:02:51,120

wavelengths brighten these surprising

72

00:02:56,470 --> 00:02:53,840

events offer a tantalizing glimpse at

73

00:03:03,160 --> 00:02:56,480

the extreme forces at work near an