



1
00:00:05,190 --> 00:00:04,309
ten

2
00:00:06,150 --> 00:00:05,200
nine

3
00:00:07,030 --> 00:00:06,160
eight

4
00:00:07,990 --> 00:00:07,040
seven

5
00:00:09,030 --> 00:00:08,000
six

6
00:00:10,070 --> 00:00:09,040
five

7
00:00:11,190 --> 00:00:10,080
four

8
00:00:12,870 --> 00:00:11,200
three

9
00:00:15,749 --> 00:00:12,880
engine start

10
00:00:17,830 --> 00:00:15,759
one zero and

11
00:00:20,790 --> 00:00:17,840
swift satellite rode to orbit aboard a

12
00:00:22,870 --> 00:00:20,800
delta rocket on november 20th 2004 and

13
00:00:25,189 --> 00:00:22,880

is still going strong

14

00:00:26,630 --> 00:00:25,199

swift's unique instrumentation allows it

15

00:00:28,870 --> 00:00:26,640

to quickly locate an interesting

16

00:00:30,470 --> 00:00:28,880

high-energy outburst automatically

17

00:00:32,069 --> 00:00:30,480

determine its position

18

00:00:35,590 --> 00:00:32,079

and rapidly investigate it with

19

00:00:37,670 --> 00:00:35,600

ultraviolet optical and x-ray telescopes

20

00:00:39,590 --> 00:00:37,680

swift's versatility has led to amazing

21

00:00:41,270 --> 00:00:39,600

observations across a wide swath of

22

00:00:43,110 --> 00:00:41,280

astronomy

23

00:00:45,190 --> 00:00:43,120

a seven year campaign to monitor the

24

00:00:47,910 --> 00:00:45,200

center of our galaxy with swift has

25

00:00:49,430 --> 00:00:47,920

given astronomers a unique bounty it has

26
00:00:51,510 --> 00:00:49,440
more than doubled the number of bright

27
00:00:53,430 --> 00:00:51,520
x-ray flares observed from our galaxy's

28
00:00:55,910 --> 00:00:53,440
central black hole and led to the

29
00:00:57,990 --> 00:00:55,920
discovery of a rare highly magnetized

30
00:01:00,229 --> 00:00:58,000
neutron star

31
00:01:03,110 --> 00:01:00,239
swift's primary target is gamma ray

32
00:01:05,990 --> 00:01:03,120
bursts or grbs the biggest and most

33
00:01:09,109 --> 00:01:06,000
mysterious explosions in the cosmos on

34
00:01:13,270 --> 00:01:09,119
april 13 2010 the spacecraft's burst

35
00:01:16,390 --> 00:01:13,280
alert telescope cataloged its 500th grb

36
00:01:18,230 --> 00:01:16,400
on september 16 2012 nasa's swift

37
00:01:19,670 --> 00:01:18,240
noticed a new and rapidly brightening

38
00:01:21,350 --> 00:01:19,680

x-ray source

39

00:01:22,789 --> 00:01:21,360

additional x-ray behavior told

40

00:01:24,870 --> 00:01:22,799

astronomers that the object at the

41

00:01:28,550 --> 00:01:24,880

center of this activity was a previously

42

00:01:32,550 --> 00:01:30,710

swift and other satellites used x-ray

43

00:01:35,190 --> 00:01:32,560

telescopes to monitor interactions

44

00:01:36,950 --> 00:01:35,200

between a pair of gigantic stars

45

00:01:39,350 --> 00:01:36,960

as the stars approach each other their

46

00:01:41,429 --> 00:01:39,360

fierce outflows called stellar winds

47

00:01:43,109 --> 00:01:41,439

crash together at several million miles

48

00:01:48,149 --> 00:01:43,119

an hour reaching temperatures of

49

00:01:52,950 --> 00:01:50,789

the swift uv mosaics allow us to study

50

00:01:56,469 --> 00:01:52,960

the evolution of young stars in the lmc

51
00:01:58,709 --> 00:01:56,479
and smc all in one view

52
00:02:01,270 --> 00:01:58,719
these images are the highest resolution

53
00:02:05,910 --> 00:02:01,280
wide field surveys of the galaxies at

54
00:02:10,949 --> 00:02:09,270
on january 21st 2014 astronomers

55
00:02:13,990 --> 00:02:10,959
discovered an exceptionally close

56
00:02:15,910 --> 00:02:14,000
stellar explosion in m82 a galaxy

57
00:02:17,190 --> 00:02:15,920
located about 12 million light years

58
00:02:19,510 --> 00:02:17,200
away

59
00:02:21,190 --> 00:02:19,520
swift's ultraviolet optical telescope

60
00:02:24,070 --> 00:02:21,200
imaged the brightening supernova the

61
00:02:29,670 --> 00:02:26,309
when a neighboring red dwarf star named

62
00:02:33,190 --> 00:02:29,680
dgcvn erupted in an enormous x-ray flare

63
00:02:35,670 --> 00:02:33,200

on april 23 2014 swift caught it and

64

00:02:38,309 --> 00:02:35,680

monitored the eruption the blast was

65

00:02:40,390 --> 00:02:38,319

some 10 000 times more powerful than the

66

00:02:41,990 --> 00:02:40,400

biggest flare we've ever seen from our

67

00:02:44,150 --> 00:02:42,000

sun

68

00:02:46,070 --> 00:02:44,160

three unusually long-lasting stellar

69

00:02:48,070 --> 00:02:46,080

explosions discovered by swift

70

00:02:49,990 --> 00:02:48,080

established a previously unrecognized

71

00:02:51,750 --> 00:02:50,000

class of grbs called ultra-long

72

00:02:53,270 --> 00:02:51,760

gamma-ray bursts

73

00:02:55,670 --> 00:02:53,280

astronomers think they arise from the

74

00:02:59,430 --> 00:02:55,680

catastrophic death of supergiant stars

75

00:03:04,470 --> 00:03:02,869

on march 28 2011 swift detected intense

76

00:03:06,390 --> 00:03:04,480

x-ray emission from a galaxy's

77

00:03:08,149 --> 00:03:06,400

supermassive black hole

78

00:03:10,149 --> 00:03:08,159

astronomers realized they were seeing

79

00:03:12,070 --> 00:03:10,159

the signal of a sun-like star being

80

00:03:13,910 --> 00:03:12,080

shredded by the black hole

81

00:03:17,589 --> 00:03:13,920

in-falling gas was captured in an

82

00:03:19,670 --> 00:03:17,599

accretion disk and powered an x-ray jet

83

00:03:22,070 --> 00:03:19,680

a record-setting blast of gamma rays

84

00:03:23,910 --> 00:03:22,080

from a dying star in a distant galaxy

85

00:03:25,910 --> 00:03:23,920

wowed astronomers around the world in

86

00:03:27,910 --> 00:03:25,920

april 2013.

87

00:03:30,789 --> 00:03:27,920

the blast produced the highest energy

88

00:03:33,589 --> 00:03:30,799

light ever detected from a grb

89

00:03:35,430 --> 00:03:33,599

uv optical x-ray and gamma-ray

90

00:03:37,750 --> 00:03:35,440

observations from swift provided

91

00:03:39,509 --> 00:03:37,760

valuable data

92

00:03:41,750 --> 00:03:39,519

asteroids crash all the time but the

93

00:03:43,430 --> 00:03:41,760

effects dissipate quickly so catching

94

00:03:46,149 --> 00:03:43,440

the aftermath of a recent collision in

95

00:03:47,830 --> 00:03:46,159

2010 was something special

96

00:03:49,430 --> 00:03:47,840

swift's ultraviolet vision helped

97

00:03:52,470 --> 00:03:49,440

astronomers rule out the possibility

98

00:03:54,710 --> 00:03:52,480

they were seeing a comet

99

00:03:57,110 --> 00:03:54,720

a grb so bright it could have been seen

100

00:03:58,949 --> 00:03:57,120

by the naked eye that's what swift and

101
00:04:02,630 --> 00:03:58,959
ground-based telescopes detected on

102
00:04:04,390 --> 00:04:02,640
march 19 2008 thanks to a grb jet aimed

103
00:04:06,309 --> 00:04:04,400
almost directly at earth

104
00:04:09,190 --> 00:04:06,319
incredibly the light from this dying

105
00:04:11,030 --> 00:04:09,200
star began its travels 7.5 billion years

106
00:04:14,149 --> 00:04:11,040
ago

107
00:04:15,990 --> 00:04:14,159
on april 29 2009 a five-second long

108
00:04:18,710 --> 00:04:16,000
burst of gamma rays became the farthest

109
00:04:21,189 --> 00:04:18,720
explosion yet identified by swift

110
00:04:23,350 --> 00:04:21,199
its light had been traveling for 13.14

111
00:04:25,990 --> 00:04:23,360
billion years placing it among the most

112
00:04:28,150 --> 00:04:26,000
distant objects known

113
00:04:29,990 --> 00:04:28,160

using swift observations astronomers

114

00:04:32,310 --> 00:04:30,000

identified an abrupt slowdown in the

115

00:04:34,629 --> 00:04:32,320

rotation of a neutron star an event

116

00:04:36,629 --> 00:04:34,639

dubbed an anti-glitch

117

00:04:38,710 --> 00:04:36,639

the discovery holds important clues for

118

00:04:40,469 --> 00:04:38,720

understanding neutron star interiors

119

00:04:42,390 --> 00:04:40,479

which contain some of the densest matter

120

00:04:44,469 --> 00:04:42,400

in the universe

121

00:04:46,550 --> 00:04:44,479

swift observations combined with

122

00:04:48,790 --> 00:04:46,560

theoretical research have shown that

123

00:04:51,510 --> 00:04:48,800

colliding neutron stars are a likely

124

00:04:54,870 --> 00:04:51,520

explanation for gamma-ray bursts lasting

125

00:04:59,909 --> 00:04:57,030

nasa's swift mission ushered in a new

126

00:05:01,749 --> 00:04:59,919

era of research into gamma-ray bursts

127

00:05:04,550 --> 00:05:01,759

as swift begins its second decade of

128

00:05:06,790 --> 00:05:04,560

operation its speed flexibility and

129

00:05:08,950 --> 00:05:06,800

versatility make it an important

130

00:05:11,270 --> 00:05:08,960

platform for studying the most energetic