1
00:00:17,810 --> 00:00:15,709
for hundreds of years thousands of years

2
00:00:20,870 --> 00:00:17,820
humans have thought the universe is a

3
00:00:22,730 --> 00:00:20,880
very static place figure out at night

4
00:00:25,490 --> 00:00:22,740
and look into the night sky you will see

5
00:00:27,830 --> 00:00:25,500
that things don't really change much the

6
00:00:30,530 --> 00:00:27,840
universe appeared very static for a long

7
00:00:32,840 --> 00:00:30,540
time we now know this is not true the

8
00:00:35,630 --> 00:00:32,850
universe is a highly dynamic place and

9
00:00:38,390 --> 00:00:35,640
things are happening all the time every

10
00:00:40,400 --> 00:00:38,400
single second a star explodes in a

11
00:00:42,230 --> 00:00:40,410
gigantic supernova explosion somewhere

12
00:00:43,910 --> 00:00:42,240
in the universe and they have to go and

13
00:00:45,680 --> 00:00:43,920

find it we have to build instruments

14
00:00:51,500 --> 00:00:45,690
that are capable of finding those

15
00:00:53,360 --> 00:00:51,510
unforeseen events way back in 1998 we

16
00:00:57,950 --> 00:00:53,370
were at a scientific meeting in Boulder

17
00:01:00,830 --> 00:00:57,960
Colorado and I was invited to invite a

18
00:01:02,870 --> 00:01:00,840
you know invitation only meeting and at

19
00:01:04,280 --> 00:01:02,880
that meeting six of us got together and

20
00:01:06,020 --> 00:01:04,290
we came up with the idea of creating

21
00:01:10,520 --> 00:01:06,030
Swift it was a group of people from

22
00:01:13,790 --> 00:01:10,530
Goddard and from Penn State Swift set

23
00:01:18,469 --> 00:01:13,800
out to combine gamma-ray instruments

24
00:01:20,840 --> 00:01:18,479
that could roughly find out where the

25
00:01:24,100 --> 00:01:20,850
gamma rays may be coming from but only

26
00:01:27,170 --> 00:01:24,110
with a very crude estimate and then

27
00:01:29,840 --> 00:01:27,180
through the design of this remarkable

28
00:01:33,950 --> 00:01:29,850
spacecraft to spin that spacecraft

29
00:01:35,990 --> 00:01:33,960
rapidly across the sky and point an

30
00:01:39,109 --> 00:01:36,000
x-ray telescope and an optical

31
00:01:41,740 --> 00:01:39,119
ultraviolet telescope at the possible

32
00:01:43,940 --> 00:01:41,750
location of the gamma ray burst

33
00:01:46,190 --> 00:01:43,950
whenever a gamma-ray burst goes off

34
00:01:47,990 --> 00:01:46,200
which happens about twice a week the

35
00:01:49,969 --> 00:01:48,000
satellite detects the gamma ray burst

36
00:01:52,700 --> 00:01:49,979
and it sends a message down to the

37
00:01:55,160 --> 00:01:52,710
ground and it goes out on a network to

38
00:01:58,460 --> 00:01:55,170

our cellphones and were paged what I

39
00:02:00,620 --> 00:01:58,470
love being a member of 50ms is carrying

40
00:02:03,590 --> 00:02:00,630
a blackberry on the side of my hip that

41
00:02:05,749 --> 00:02:03,600
became almost like a part of my body and

42
00:02:07,310 --> 00:02:05,759
and every time Swift discovered

43
00:02:07,760 --> 00:02:07,320
something unforeseen or a gamma-ray

44
00:02:09,979 --> 00:02:07,770
burst

45
00:02:11,390 --> 00:02:09,989
went off the BlackBerry star bright

46
00:02:13,039 --> 00:02:11,400
vibrating and I would

47
00:02:14,390 --> 00:02:13,049
run to the nearest computer as fast as I

48
00:02:17,119 --> 00:02:14,400
could

49
00:02:18,440 --> 00:02:17,129
and and this is something I miss now not

50
00:02:20,990 --> 00:02:18,450
working anymore for Swift this

51
00:02:23,289 --> 00:02:21,000
excitement that things can happen at any

52
00:02:26,960 --> 00:02:23,299
time and you don't know what it is I

53
00:02:29,319 --> 00:02:26,970
have on two occasions gotten a gamma-ray

54
00:02:33,170 --> 00:02:29,329
burst alert while I was giving a lecture

55
00:02:35,000 --> 00:02:33,180
about Swift and so I told the audience

56
00:02:37,699 --> 00:02:35,010
that here's the new gamma-ray burst

57
00:02:40,640 --> 00:02:37,709
coming in and we actually one time got

58
00:02:42,199 --> 00:02:40,650
it on the screen and watched the data as

59
00:02:45,949 --> 00:02:42,209
they were coming in in front of the

60
00:02:48,860 --> 00:02:45,959
audience I was woken up by GRB own I

61
00:02:51,050 --> 00:02:48,870
know 423 it was 4:00 in the morning it

62
00:02:52,849 --> 00:02:51,060
was really annoying it was five years

63
00:02:55,490 --> 00:02:52,859

into the mission so geo views were not

64
00:02:58,250 --> 00:02:55,500
so new and exciting then I was like oh

65
00:03:00,349 --> 00:02:58,260
yeah yet another GRB dealt with it went

66
00:03:02,539 --> 00:03:00,359
back to sleep woke up the next morning

67
00:03:04,039 --> 00:03:02,549
and there was information from

68
00:03:05,990 --> 00:03:04,049
ground-based telescopes that had

69
00:03:07,789 --> 00:03:06,000
observed this gamma-ray burst in the

70
00:03:09,770 --> 00:03:07,799
infrared that we're implying that it was

71
00:03:11,509 --> 00:03:09,780
a very distant gamma-ray burst at

72
00:03:14,740 --> 00:03:11,519
redshifts greater than each that was

73
00:03:18,319 --> 00:03:14,750
very exciting and the next night

74
00:03:19,879 --> 00:03:18,329
telescopes in Hawaii were able to

75
00:03:22,490 --> 00:03:19,889
confirm that redshift that it's at a

76
00:03:25,759 --> 00:03:22,500
redshift of Z of 8.2 that means that

77
00:03:28,339 --> 00:03:25,769
gamma ray bursts went off more than 13

78
00:03:30,770 --> 00:03:28,349
billion years ago it's 13 billion light

79
00:03:33,379 --> 00:03:30,780
years away we're seeing light that from

80
00:03:36,229 --> 00:03:33,389
a star that was only 700 million years

81
00:03:38,270 --> 00:03:36,239
after the Big Bang that's one of the

82
00:03:41,449 --> 00:03:38,280
most distant objects has ever been

83
00:03:43,580 --> 00:03:41,459
detected that was very cool in my case I

84
00:03:47,240 --> 00:03:43,590
had a different experience where it was

85
00:03:48,949 --> 00:03:47,250
Thanksgiving and we had my family and I

86
00:03:50,629 --> 00:03:48,959
had spent a large amount of time working

87
00:03:52,939 --> 00:03:50,639
to prevent the Thanksgiving dinner we

88
00:03:54,349 --> 00:03:52,949

had friends around and everything was

89
00:03:56,689 --> 00:03:54,359
ready the food was on the table

90
00:03:59,990 --> 00:03:56,699
and right as I put my fork into my

91
00:04:01,699 --> 00:04:00,000
turkey the my phone went off something

92
00:04:04,879 --> 00:04:01,709
had exploded in the universe with the

93
00:04:06,830 --> 00:04:04,889
detected it and we had to go to work so

94
00:04:10,899 --> 00:04:06,840
it doesn't always happen at convenient

95
00:04:13,819 --> 00:04:10,909
times but it is still exciting basically

96
00:04:16,250 --> 00:04:13,829
I'm on call 24 hours a day so it's hard

97
00:04:17,960 --> 00:04:16,260
to decide where my personal life starts

98
00:04:22,370 --> 00:04:17,970
and where my as Swift professional life

99
00:04:23,540 --> 00:04:22,380
ends as the astronomy and astrophysics

100
00:04:26,210 --> 00:04:23,550
community has

101
00:04:28,279 --> 00:04:26,220
engaged with Swift the scientists have

102
00:04:32,390 --> 00:04:28,289
learned new ways to use the observatory

103
00:04:35,390 --> 00:04:32,400
and its ability to rapidly follow up new

104
00:04:38,390 --> 00:04:35,400
sources has been seen as a really

105
00:04:40,040 --> 00:04:38,400
incredibly useful tool and so Swift is

106
00:04:41,960 --> 00:04:40,050
evolved from spending most of its time

107
00:04:43,520 --> 00:04:41,970
observing gamma-ray bursts and following

108
00:04:46,820 --> 00:04:43,530
them for sometimes weeks or months

109
00:04:48,619 --> 00:04:46,830
afterwards to doing more science that's

110
00:04:51,260 --> 00:04:48,629
proposed by the community to study other

111
00:04:55,930 --> 00:04:51,270
types of objects we look at supernova

112
00:04:59,240 --> 00:04:55,940
novi black hole transients comets

113
00:05:02,360 --> 00:04:59,250

flaring stars all different kinds of

114
00:05:04,490 --> 00:05:02,370
objects basically every year Swift makes

115
00:05:06,350 --> 00:05:04,500
a new discovery that changes some field

116
00:05:08,180 --> 00:05:06,360
of astrophysics we have made many many

117
00:05:09,619 --> 00:05:08,190
discoveries in other areas we've

118
00:05:11,959 --> 00:05:09,629
discovered something called a tidal

119
00:05:13,520 --> 00:05:11,969
disruption event that's when a star is

120
00:05:15,409 --> 00:05:13,530
falling into a black hole and gets

121
00:05:17,059 --> 00:05:15,419
ripped to shreds and we see the light

122
00:05:19,580 --> 00:05:17,069
from that collapse onto the black hole

123
00:05:21,439 --> 00:05:19,590
that's very very exciting we've made

124
00:05:23,270 --> 00:05:21,449
important discoveries about comets

125
00:05:25,129 --> 00:05:23,280
how much water and how much other

126
00:05:27,529 --> 00:05:25,139
material there is in comets that people

127
00:05:30,350 --> 00:05:27,539
didn't know before we have actually seen

128
00:05:32,990 --> 00:05:30,360
a supernova star that blows up at the

129
00:05:36,050 --> 00:05:33,000
moment when the light broke out from the

130
00:05:38,120 --> 00:05:36,060
surface of the exploding star every year

131
00:05:40,610 --> 00:05:38,130
for the ten years of Swift we've had one

132
00:05:44,480 --> 00:05:40,620
of these really important discoveries it

133
00:05:47,779 --> 00:05:44,490
is the Cadillac of satellites it does

134
00:05:51,860 --> 00:05:47,789
everything in the transient filter in

135
00:05:54,920 --> 00:05:51,870
one package and mind you this is a small

136
00:05:58,610 --> 00:05:54,930
packets it's an Explorer mission we have

137
00:06:00,680 --> 00:05:58,620
a huge amount of capability Swift's

138
00:06:02,480 --> 00:06:00,690

ability to observe many objects in one

139
00:06:04,219 --> 00:06:02,490
day I think is what makes it special as

140
00:06:06,769 --> 00:06:04,229
well as its ability to respond very

141
00:06:08,839 --> 00:06:06,779
quickly to new events in the in the

142
00:06:12,439 --> 00:06:08,849
universe norther mission is as agile as

143
00:06:14,860 --> 00:06:12,449
we are Swift performs every day five to

144
00:06:17,659 --> 00:06:14,870
seven target of opportunities or

145
00:06:19,969 --> 00:06:17,669
societal requested by the astronomers to

146
00:06:22,399 --> 00:06:19,979
be observed and they are observed every

147
00:06:24,649 --> 00:06:22,409
days and and this is a very powerful

148
00:06:27,830 --> 00:06:24,659
capability that the community now is

149
00:06:30,290 --> 00:06:27,840
taking advantage of I knew the

150
00:06:32,659 --> 00:06:30,300
instrument I knew its capabilities but

151
00:06:34,460 --> 00:06:32,669
I've been extremely impressed with the

152
00:06:37,040 --> 00:06:34,470
team of people that behind

153
00:06:40,640 --> 00:06:37,050
the scenes make the mission work there

154
00:06:44,030 --> 00:06:40,650
is a group of duty scientists mission

155
00:06:46,970 --> 00:06:44,040
planners the flight operations team that

156
00:06:50,300 --> 00:06:46,980
make sure that we can continue to

157
00:06:53,240 --> 00:06:50,310
observe as many targets as we do we can

158
00:06:55,490 --> 00:06:53,250
continue to do the rapid response that

159
00:06:58,040 --> 00:06:55,500
is really unique to the observatory and

160
00:07:00,980 --> 00:06:58,050
without such a dedicated crew of people

161
00:07:02,840 --> 00:07:00,990
behind the scenes I don't think so it

162
00:07:07,280 --> 00:07:02,850
would be nearly as successful as it has

163
00:07:11,750 --> 00:07:07,290

been Swift mission has been extremely

164
00:07:15,830 --> 00:07:11,760
successful in the past up to now and it

165
00:07:20,270 --> 00:07:15,840
will no doubt continue to be successful

166
00:07:24,470 --> 00:07:20,280
in the future and I am sure that a lot

167
00:07:28,790 --> 00:07:24,480
of serendipitous science is just waiting

168
00:07:31,820 --> 00:07:28,800
for us the universe has a lot of Secrets

169
00:07:35,180 --> 00:07:31,830
that have not been revealed yet we do

170
00:07:39,080 --> 00:07:35,190
believe that shrift can and will reveal

171
00:07:41,540 --> 00:07:39,090
many more mysteries and puzzles in the

172
00:07:44,060 --> 00:07:41,550
universe we don't know what will happen

173
00:07:47,150 --> 00:07:44,070
over the next 10 years hoping that Swift

174
00:07:50,000 --> 00:07:47,160
will still give us exciting data but

175
00:07:52,400 --> 00:07:50,010
what we do know is that Swift will give

176
00:07:55,700 --> 00:07:52,410
us exciting new data because of its pure

177
00:07:58,250 --> 00:07:55,710
nature this is what it was built for to

178
00:08:00,530 --> 00:07:58,260
study new unforeseen unexpected events

179
00:08:04,400 --> 00:08:00,540
and they will inevitably happen it's

180
00:08:08,090 --> 00:08:04,410
been a part of my life every day for the

181
00:08:11,450 --> 00:08:08,100
last 20 years I love it it's produced so

182
00:08:14,590 --> 00:08:11,460
much great science and it's been very

183
00:08:18,980 --> 00:08:14,600
fulfilling but every day I think about

184
00:08:21,490 --> 00:08:18,990
this delicate instrumentation in the

185
00:08:24,560 --> 00:08:21,500
harsh environment orbiting the Earth and

186
00:08:27,050 --> 00:08:24,570
how its able to keep going all of those

187
00:08:30,720 --> 00:08:27,060
years and I very often will just look up