

1
00:00:07,110 --> 00:00:13,559
Oh as soon as the hubble space telescope

2
00:00:10,769 --> 00:00:18,210
was launched astronomers were clamoring

3
00:00:13,558 --> 00:00:20,789
to see what it could do the problem was

4
00:00:18,210 --> 00:00:24,120
there was only so much observing time to

5
00:00:20,789 --> 00:00:25,950
go around was still not clear if you

6
00:00:24,120 --> 00:00:28,320
just took what we call a blank field

7
00:00:25,949 --> 00:00:31,289
some in distinguished field of the sky

8
00:00:28,320 --> 00:00:33,719
and sat Hubble on it and took picture

9
00:00:31,289 --> 00:00:36,058
after picture electronically added them

10
00:00:33,719 --> 00:00:37,620
for a period of 10 days that you'd come

11
00:00:36,058 --> 00:00:40,169
up with something that people would say

12
00:00:37,619 --> 00:00:42,599
yeah this was worth it a job like that

13
00:00:40,170 --> 00:00:45,329
meant other projects would have to wait

14
00:00:42,600 --> 00:00:48,539
their turn telescopes are time machines

15
00:00:45,329 --> 00:00:50,009
because they look back to earlier times

16
00:00:48,539 --> 00:00:52,109
the light has been traveling for such a

17
00:00:50,009 --> 00:00:54,539
long time to get to us that it left a

18
00:00:52,109 --> 00:00:55,979
long time ago we had a theory that said

19
00:00:54,539 --> 00:00:58,379
that galaxies should look really

20
00:00:55,979 --> 00:00:59,339
different back in time they should be

21
00:00:58,380 --> 00:01:01,859
smaller

22
00:00:59,340 --> 00:01:04,219
they should be bluer and they should be

23
00:01:01,859 --> 00:01:06,840
more irregular because they were still

24
00:01:04,218 --> 00:01:09,569
accumulating as the mass fell together

25
00:01:06,840 --> 00:01:12,630
via gravity all three of those

26
00:01:09,569 --> 00:01:14,728
predictions were confirmed in the very

27
00:01:12,629 --> 00:01:17,670
first couple pictures that was really my

28
00:01:14,728 --> 00:01:20,370
gotcha moment it was great the galaxies

29

00:01:17,670 --> 00:01:21,659
were much smaller much more distorted if

30
00:01:20,370 --> 00:01:23,670
you like there weren't really galaxies

31
00:01:21,659 --> 00:01:25,170
they were just pieces of stuff star

32
00:01:23,670 --> 00:01:27,359
clusters coming together to form

33
00:01:25,170 --> 00:01:32,010
galaxies the first images that were

34
00:01:27,359 --> 00:01:34,829
taken in the mid 90s were i opening but

35
00:01:32,010 --> 00:01:37,140
then we put a new camera on in 2002 and

36
00:01:34,829 --> 00:01:41,728
that just was hugely different bigger

37
00:01:37,140 --> 00:01:43,710
better brighter more distant while that

38
00:01:41,728 --> 00:01:45,750
follow on Deep Field image added to our

39
00:01:43,709 --> 00:01:48,298
understanding of the early universe it

40
00:01:45,750 --> 00:01:50,489
was the last servicing mission in 2009

41
00:01:48,299 --> 00:01:52,740
that allowed us to see all the way back

42
00:01:50,489 --> 00:01:55,408
to when the universe was essentially a

43
00:01:52,739 --> 00:01:57,419

toddler they put on this new Wide Field

44

00:01:55,409 --> 00:01:59,700

Camera and that gave it an infrared

45

00:01:57,420 --> 00:02:01,769

sensitivity and suddenly we were back to

46

00:01:59,700 --> 00:02:03,600

within a half a billion years of the Big

47

00:02:01,769 --> 00:02:06,328

Bang if you think of human development

48

00:02:03,599 --> 00:02:08,639

the difference in looking at a toddler

49

00:02:06,328 --> 00:02:11,759

between one year and two years or six

50

00:02:08,639 --> 00:02:13,259

months and two years is enormous so even

51

00:02:11,759 --> 00:02:15,389

though it's only going back another

52

00:02:13,259 --> 00:02:16,989

couple of billion years you're actually

53

00:02:15,389 --> 00:02:20,559

looking at something in a much

54

00:02:16,990 --> 00:02:22,810

more nascent state of development as the

55

00:02:20,560 --> 00:02:24,039

development of the cosmos continues to

56

00:02:22,810 --> 00:02:26,050

be a burning question

57

00:02:24,039 --> 00:02:30,159

astronomers are getting another assist

58
00:02:26,050 --> 00:02:32,439
from the universe itself instead of

59
00:02:30,159 --> 00:02:35,349
looking at essentially a none special

60
00:02:32,439 --> 00:02:38,079
piece of sky they proposed looking at a

61
00:02:35,349 --> 00:02:40,810
very special place the fields around

62
00:02:38,080 --> 00:02:43,600
strong lensing clusters the most massive

63
00:02:40,810 --> 00:02:45,759
objects and the universe and Einstein's

64
00:02:43,599 --> 00:02:48,639
theory of general relativity tells us

65
00:02:45,759 --> 00:02:51,280
that space and time is bent around those

66
00:02:48,639 --> 00:02:54,129
objects and so they can actually act as

67
00:02:51,280 --> 00:02:56,229
natural telescopes bending the light and

68
00:02:54,129 --> 00:02:58,599
magnifying the light from galaxies that

69
00:02:56,229 --> 00:03:01,209
are behind that basically we're using

70
00:02:58,599 --> 00:03:04,269
Hubble in combination with nature's

71
00:03:01,210 --> 00:03:06,580
telescopes to see farther than we could

72
00:03:04,270 --> 00:03:08,800
possibly see with Hubble alone the

73
00:03:06,580 --> 00:03:11,460
so-called deep fields are the longest

74
00:03:08,800 --> 00:03:13,960
images ever taken of the universe and

75
00:03:11,460 --> 00:03:15,640
some of the most informative pictures

76
00:03:13,960 --> 00:03:19,180
ever taken by human beings they're a

77
00:03:15,639 --> 00:03:21,969
real milestone in the course of human

78
00:03:19,180 --> 00:03:23,439
science while Hubble is still showing

79
00:03:21,969 --> 00:03:26,169
how the universe has evolved over

80
00:03:23,439 --> 00:03:28,659
billions of years there's still much we

81
00:03:26,169 --> 00:03:31,839
don't know we haven't found the very

82
00:03:28,659 --> 00:03:33,819
first generation of galaxies that would

83
00:03:31,840 --> 00:03:35,620
be an amazing time we call it cosmic

84
00:03:33,819 --> 00:03:38,289
dawn when the universe switched on

85
00:03:35,620 --> 00:03:40,480
starlight for the first time now was

86

00:03:38,289 --> 00:03:43,780
this a sudden moment did the universe

87
00:03:40,479 --> 00:03:47,259
suddenly go from darkness to light or is

88
00:03:43,780 --> 00:03:49,509
it a gradual process answers to these

89
00:03:47,259 --> 00:03:51,669
questions and many more will have to

90
00:03:49,509 --> 00:03:53,859
wait until Hubble's successor the James

91
00:03:51,669 --> 00:03:55,659
Webb Space Telescope takes over the

92
00:03:53,860 --> 00:03:58,920
reigns as it's primed with infrared

93
00:03:55,659 --> 00:04:00,909
vision to look even farther back in time

94
00:03:58,919 --> 00:04:03,579
from the Space Telescope Science

95
00:04:00,909 --> 00:04:06,120
Institute in Baltimore Maryland I'm Mary

96
00:04:03,580 --> 00:04:06,120
Estacion