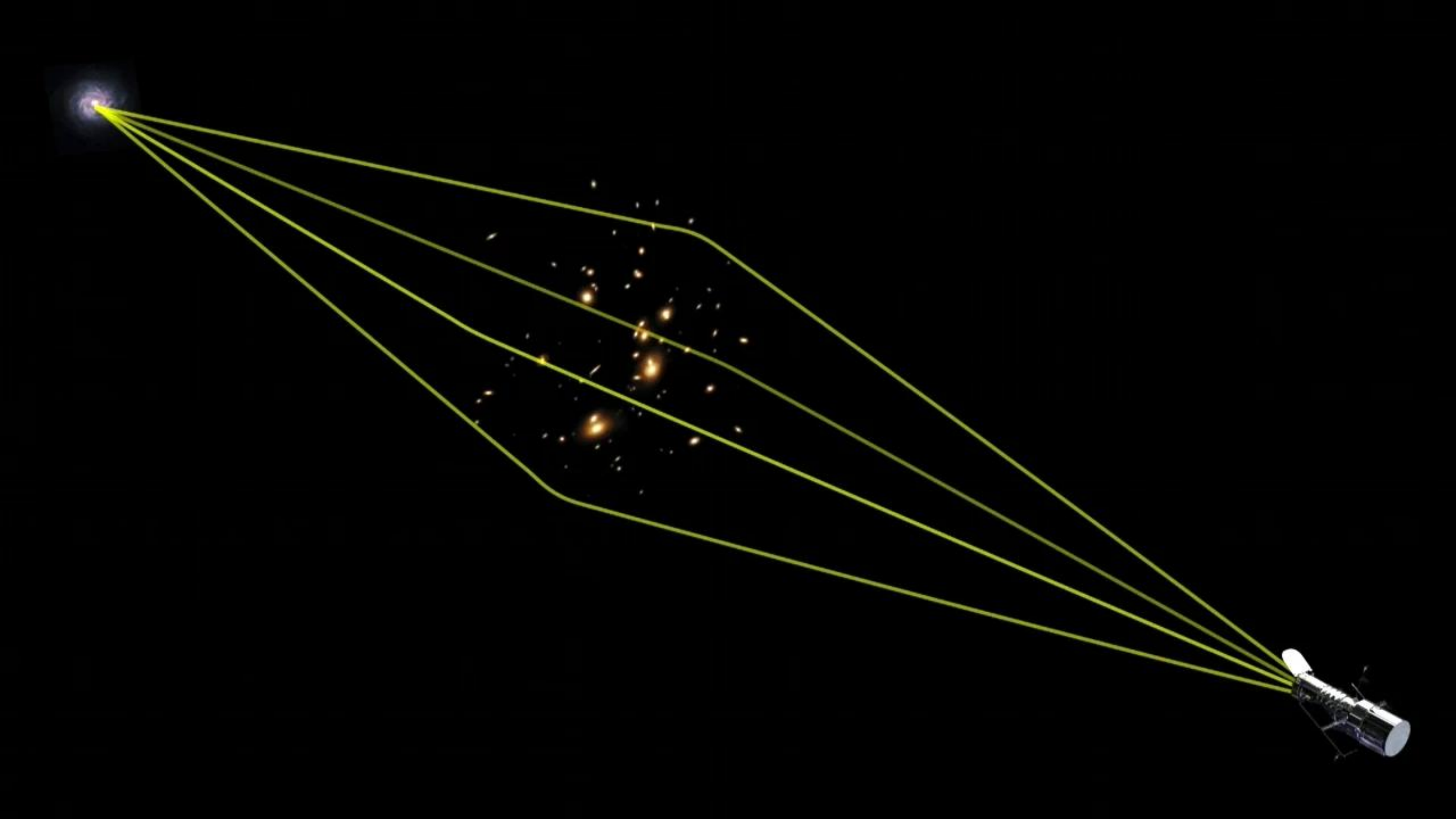

1
00:00:08,880 --> 00:00:12,100
As soon as the Hubble Space
Telescope was launched,

2
00:00:12,100 --> 00:00:16,930
astronomers were clamoring to see what
it could do… (loud cheers)

3
00:00:16,930 --> 00:00:22,170
the problem was there is only so much
observing time to go around

4
00:00:22,170 --> 00:00:26,850
Bob Williams: "It was still not clear if you just took
what we call a blank field some

5
00:00:26,850 --> 00:00:29,480
indistinguished thing which field of the sky

6
00:00:29,480 --> 00:00:33,750
and sat Hubble on it and took picture after
picture electronically added them

7
00:00:33,750 --> 00:00:37,559
for a period of ten days that you'd come
up with something that people would say

8
00:00:37,559 --> 00:00:39,550
'yeah, this was worth it.'

9
00:00:39,550 --> 00:00:43,600
A job like that meant other projects
would have to wait their turn.

10
00:00:43,600 --> 00:00:46,770
Alan Dressler: Telescopes are time machines because
they look back

11
00:00:46,770 --> 00:00:50,890

to earlier times. The light has been
traveling for such a long time to get to

12
00:00:50,890 --> 00:00:53,180
us that it left a long time ago.

13
00:00:53,180 --> 00:00:56,830
Sandra Faber: We had a theory that said that galaxies
should look really different back in time.

14
00:00:57,330 --> 00:01:01,080
They should be smaller. They should be
bluer,

15
00:01:01,080 --> 00:01:04,300
and they should be more irregular
because they were still

16
00:01:04,300 --> 00:01:08,040
accumulating as the mass fell together
via gravity.

17
00:01:08,040 --> 00:01:13,290
All three of those predictions were
confirmed in the very first Hubble pictures.

18
00:01:13,290 --> 00:01:15,290
That was my really gotcha moment. It was great.

19
00:01:16,800 --> 00:01:22,040
Steve Beckwith: The galaxies were much smaller, much more distorted if you like they
weren't really galaxies.

20
00:01:22,040 --> 00:01:23,270
They were just pieces of stuff,

21
00:01:23,270 --> 00:01:25,800
star clusters coming together to form
galaxies.

22
00:01:26,200 --> 00:01:27,979
Garth Illingworth: The first images that were taken

23
00:01:27,979 --> 00:01:31,700
in the mid 90s were eye-opening

24
00:01:31,700 --> 00:01:36,609
but then we put a new camera on it in 2002
and that just was hugely different

25
00:01:36,609 --> 00:01:41,000
bigger, better, brighter… more distant.

26
00:01:41,000 --> 00:01:42,530
While that follow-on deep field image

27
00:01:42,530 --> 00:01:45,770
added to our understanding
of the early universe,

28
00:01:45,770 --> 00:01:49,789
it was the last servicing mission in
2009 that allowed us to see

29
00:01:49,789 --> 00:01:53,420
all the way back to when the universe
was essentially a toddler.

30
00:01:53,420 --> 00:01:57,109
Alan Dressler: They put on this new Wide Field Camera
and that gave it an

31
00:01:57,109 --> 00:02:02,000
infrared sensitivity and suddenly we were
back to within a half a billion years of the Big Bang.

32
00:02:02,200 --> 00:02:05,740
Beckwith: If you think of human
development, the difference in looking at

33
00:02:05,740 --> 00:02:08,070
a toddler between one year and two years

34
00:02:08,070 --> 00:02:12,950
or six months and two years is enormous
so even though it's only going back

35
00:02:13,000 --> 00:02:17,020
another couple billion years you're actually
looking at something in a much

36
00:02:17,020 --> 00:02:20,300
more nascent state of development.

37
00:02:20,300 --> 00:02:24,140
As the development of the cosmos
continues to be a burning question,

38
00:02:24,140 --> 00:02:27,920
astronomers are getting another assist
from the universe itself.

39
00:02:27,920 --> 00:02:31,550
Jennifer Lotz: Instead of looking at essentially

40
00:02:31,550 --> 00:02:34,700
an unspecial piece of sky, they proposed

41
00:02:34,700 --> 00:02:39,180
looking at a very special place... the
fields around strong lensing

42
00:02:39,180 --> 00:02:42,190
clusters... the most massive objects in the universe.

43
00:02:42,190 --> 00:02:45,270
and Einstein's Theory of General Relativity

44
00:02:45,270 --> 00:02:49,310
tells us that space and time is bent
around those objects

45
00:02:49,310 --> 00:02:54,040
and so they can actually act as natural
telescopes, bending the light

46
00:02:54,040 --> 00:02:57,000
and magnifying the light from galaxies that are
behind that.

47
00:02:57,000 --> 00:02:59,000
Basically, we're using Hubble

48
00:02:59,330 --> 00:03:02,490
in combination with nature's telescopes to see

49
00:03:02,490 --> 00:03:05,730
farther than we could possibly see with
Hubble alone.

50
00:03:05,730 --> 00:03:09,530
Faber: The so-called Deep Fields are the longest
images

51
00:03:09,530 --> 00:03:13,540
ever taken of the universe and some of the
most informative

52
00:03:13,540 --> 00:03:17,360
pictures ever taken by human beings.
They're a real milestone

53
00:03:17,360 --> 00:03:19,000
in the course of human science.

54
00:03:20,000 --> 00:03:22,230
While Hubble is still showing how the

55
00:03:22,230 --> 00:03:24,800
universe has evolved over billions of years,

56
00:03:24,800 --> 00:03:27,500
there's still much we don't know.

57
00:03:27,500 --> 00:03:30,000
We haven't found the very first generation of galaxies.

58
00:03:30,730 --> 00:03:34,430
That would be an amazing time. We call it
cosmic dawn...

59
00:03:34,430 --> 00:03:37,430
when the universe switched on...starlight
for the first time

60
00:03:37,430 --> 00:03:42,150
Now, was this a sudden moment? Did the
universe suddenly go from darkness

61
00:03:42,150 --> 00:03:45,360
to light? Or was it a gradual process?

62
00:03:46,000 --> 00:03:48,920
Answers to these questions and many
more

63
00:03:48,920 --> 00:03:52,530
will have to wait until Hubble's
successor, the James Webb Space Telescope,

64
00:03:52,530 --> 00:03:56,480
takes over the reins at its primed with
infrared vision

65
00:03:56,480 --> 00:03:57,500
to look even farther back in time.