1
00:00:12,070 --> 00:00:09,990
[Music]

2
00:00:13,589 --> 00:00:12,080
hubble laid the groundwork that you can

3
00:00:15,589 --> 00:00:13,599
do things in space

4
00:00:17,189 --> 00:00:15,599
with a telescope that wasn't planned to

5
00:00:19,109 --> 00:00:17,199
do that observation

6
00:00:20,950 --> 00:00:19,119
we have pushed the instruments to a

7
00:00:22,710 --> 00:00:20,960
level that wasn't expected even by the

8
00:00:24,870 --> 00:00:22,720
people who built the instrument

9
00:00:27,029 --> 00:00:24,880
hubble has made huge advances in this

10
00:00:29,509 --> 00:00:27,039
field of planets orbiting other stars

11
00:00:31,509 --> 00:00:29,519
and in particular hubble made the first

12
00:00:33,110 --> 00:00:31,519
discovery of an atmosphere around

13
00:00:33,990 --> 00:00:33,120

another planet outside of our solar

14
00:00:35,750 --> 00:00:34,000
system

15
00:00:37,910 --> 00:00:35,760
for the first time in history we were

16
00:00:40,310 --> 00:00:37,920
studying the chemical composition of

17
00:00:42,869 --> 00:00:40,320
other planets and of course that really

18
00:00:44,709 --> 00:00:42,879
is the bright future of extrasolar

19
00:00:47,110 --> 00:00:44,719
planets learning their nature and

20
00:00:48,709 --> 00:00:47,120
especially whether they have signs of

21
00:00:50,790 --> 00:00:48,719
life on them

22
00:00:52,549 --> 00:00:50,800
if there were no hubble we would have

23
00:00:54,310 --> 00:00:52,559
known from some of these repetitive

24
00:00:56,389 --> 00:00:54,320
measurements on the ground

25
00:00:58,630 --> 00:00:56,399
that there are planets orbiting other

26
00:01:01,750 --> 00:00:58,640
stars but most of the ones known would

27
00:01:04,310 --> 00:01:01,760
be very close into the star closer than

28
00:01:06,789 --> 00:01:04,320
mercury is to the sun which means that

29
00:01:09,670 --> 00:01:06,799
they're very hot planets not places

30
00:01:11,270 --> 00:01:09,680
you'd care to visit

31
00:01:13,190 --> 00:01:11,280
we learned a lot about the outer solar

32
00:01:15,749 --> 00:01:13,200
system from the voyager flybys in the

33
00:01:18,230 --> 00:01:15,759
mid 1980s but they really gave us just a

34
00:01:20,950 --> 00:01:18,240
quick snapshot of planets that turn out

35
00:01:23,109 --> 00:01:20,960
to be really very dynamic hubble has

36
00:01:26,230 --> 00:01:23,119
provided some of the most spectacular

37
00:01:27,990 --> 00:01:26,240
imaging of outer planets that we've been

38
00:01:31,109 --> 00:01:28,000

able to get aside from sending a

39
00:01:33,429 --> 00:01:31,119
spacecraft there it's fabulous

40
00:01:35,990 --> 00:01:33,439
resolution allows us to see details in

41
00:01:38,069 --> 00:01:36,000
the cloud patterns it allows us to study

42
00:01:41,670 --> 00:01:38,079
the moons and the ring systems of these

43
00:01:43,670 --> 00:01:41,680
outer planets with unprecedented detail

44
00:01:46,550 --> 00:01:43,680
it's really been a workhorse for the

45
00:01:48,630 --> 00:01:46,560
outer solar system astronomy program

46
00:01:50,630 --> 00:01:48,640
we know that the galaxy is there based

47
00:01:51,910 --> 00:01:50,640
on a ground-based picture but it's a

48
00:01:54,069 --> 00:01:51,920
blob

49
00:01:57,030 --> 00:01:54,079
hubble is able to take pictures of the

50
00:01:58,310 --> 00:01:57,040
galaxy and not only a single picture but

51
00:02:00,149 --> 00:01:58,320
sharp pictures at a whole bunch of

52
00:02:03,350 --> 00:02:00,159
different wavelengths and every

53
00:02:06,469 --> 00:02:03,360
wavelength has a different story to tell

54
00:02:08,150 --> 00:02:06,479
hubble will be remembered for

55
00:02:09,430 --> 00:02:08,160
discovering black holes in nearby

56
00:02:11,350 --> 00:02:09,440
galaxies

57
00:02:13,990 --> 00:02:11,360
taking the first high-resolution

58
00:02:16,710 --> 00:02:14,000
pictures of the early universe

59
00:02:19,030 --> 00:02:16,720
and i think for many contributions on

60
00:02:22,390 --> 00:02:19,040
star formation

61
00:02:24,390 --> 00:02:22,400
we as scientists should learn

62
00:02:26,229 --> 00:02:24,400
from the hubble experience

63
00:02:28,550 --> 00:02:26,239

that it's very important to communicate

64
00:02:30,150 --> 00:02:28,560
to the public what we do and habal has

65
00:02:31,750 --> 00:02:30,160
done a really good job at that i mean

66
00:02:32,710 --> 00:02:31,760
it's easy because they're stunning

67
00:02:34,470 --> 00:02:32,720
pictures

68
00:02:37,190 --> 00:02:34,480
but there's also a lot of work that goes

69
00:02:40,150 --> 00:02:37,200
into that

70
00:02:41,990 --> 00:02:40,160
in some perverse way hubble's impact has

71
00:02:42,790 --> 00:02:42,000
been heightened by the fact that it went

72
00:02:44,630 --> 00:02:42,800
through

73
00:02:45,990 --> 00:02:44,640
trouble

74
00:02:47,350 --> 00:02:46,000
that brought it to the public's

75
00:02:50,710 --> 00:02:47,360
attention

76
00:02:52,470 --> 00:02:50,720
and the fix was dramatic and involved a

77
00:02:54,309 --> 00:02:52,480
human interest element

78
00:02:57,190 --> 00:02:54,319
that makes the telescope larger than

79
00:02:58,790 --> 00:02:57,200
life it's more than just a telescope for

80
00:03:01,430 --> 00:02:58,800
the average person

81
00:03:02,730 --> 00:03:01,440
it also becomes a symbol of american