


We Asked NASA Scientists and Astronauts...

"What is your Favorite Hubble Image?"


1
00:00:11,110 --> 00:00:10,310
[Music]

2
00:00:13,030 --> 00:00:11,120
hi

3
00:00:18,790 --> 00:00:13,040
my name is paul morris and i'm a video

4
00:00:22,710 --> 00:00:20,870
over the years i've had the amazing

5
00:00:25,029 --> 00:00:22,720
opportunity to interview some of the

6
00:00:27,429 --> 00:00:25,039
brightest minds in astrophysics and some

7
00:00:28,710 --> 00:00:27,439
of the coolest astronauts and people in

8
00:00:31,429 --> 00:00:28,720
the world

9
00:00:33,670 --> 00:00:31,439
as a rule i always ask every single

10
00:00:34,630 --> 00:00:33,680
person this one question

11
00:00:35,590 --> 00:00:34,640
every

12
00:00:38,709 --> 00:00:35,600
single

13
00:00:40,869 --> 00:00:38,719

time this is the cliche question but

14
00:00:41,750 --> 00:00:40,879
always what's your favorite hubble image

15
00:00:44,470 --> 00:00:41,760
oh

16
00:00:46,790 --> 00:00:44,480
whoa it's my favorite hubble image

17
00:00:48,790 --> 00:00:46,800
ah

18
00:00:52,069 --> 00:00:48,800
can you talk about your favorite hubble

19
00:00:55,990 --> 00:00:54,150
what is your favorite hubble image in

20
00:00:58,229 --> 00:00:56,000
water

21
00:01:00,150 --> 00:00:58,239
what is your favorite hubble image and

22
00:01:02,069 --> 00:01:00,160
why

23
00:01:03,110 --> 00:01:02,079
i began to see a pattern in their

24
00:01:05,189 --> 00:01:03,120
answers

25
00:01:07,270 --> 00:01:05,199
the hubble deep field the ultra deep

26
00:01:08,550 --> 00:01:07,280
field the ultra deep field one of the

27
00:01:10,550 --> 00:01:08,560
questions you were going to ask me was

28
00:01:12,710 --> 00:01:10,560
what was my favorite image my favorite

29
00:01:15,109 --> 00:01:12,720
image is the deep feel image it's um

30
00:01:16,710 --> 00:01:15,119
because it's one that that tells an

31
00:01:18,630 --> 00:01:16,720
incredible

32
00:01:21,910 --> 00:01:18,640
story about our universe

33
00:01:24,149 --> 00:01:21,920
back in 1994 robert williams then

34
00:01:26,550 --> 00:01:24,159
director of the space telescope science

35
00:01:27,990 --> 00:01:26,560
institute in baltimore maryland came up

36
00:01:29,990 --> 00:01:28,000
with a plan

37
00:01:31,670 --> 00:01:30,000
he wanted to point hubble at a spot in

38
00:01:33,109 --> 00:01:31,680

the sky where there was seemingly

39
00:01:35,109 --> 00:01:33,119
nothing there

40
00:01:36,950 --> 00:01:35,119
a lot of scientists and astronomers at

41
00:01:39,429 --> 00:01:36,960
the time thought this was a huge waste

42
00:01:41,350 --> 00:01:39,439
of valuable hubble resources and pushed

43
00:01:43,590 --> 00:01:41,360
back

44
00:01:44,870 --> 00:01:43,600
williams however continued forward with

45
00:01:46,389 --> 00:01:44,880
his plan

46
00:01:48,630 --> 00:01:46,399
he controlled 10

47
00:01:51,510 --> 00:01:48,640
of hubble's observation time known as

48
00:01:53,350 --> 00:01:51,520
director's discretionary time he decided

49
00:01:55,510 --> 00:01:53,360
to use some of that to take a long

50
00:01:57,350 --> 00:01:55,520
exposure that would be made immediately

51
00:02:01,030 --> 00:01:57,360
available to the public

52
00:02:03,590 --> 00:02:01,040
taken over the course of 10 days in 1995

53
00:02:06,310 --> 00:02:03,600
the hubble deep field captured roughly 3

54
00:02:09,190 --> 00:02:06,320
000 distant galaxies in various stages

55
00:02:11,350 --> 00:02:09,200
of evolution three thousand galaxies

56
00:02:13,990 --> 00:02:11,360
where it seemed like there was nothing

57
00:02:16,470 --> 00:02:14,000
the world was stunned

58
00:02:18,630 --> 00:02:16,480
when we finally looked at what came back

59
00:02:21,589 --> 00:02:18,640
it was one of the most

60
00:02:24,229 --> 00:02:21,599
mind-boggling images of the whole

61
00:02:25,510 --> 00:02:24,239
hubble collection galaxies with billions

62
00:02:27,430 --> 00:02:25,520
of stars and

63
00:02:29,430 --> 00:02:27,440

billions of planets we know nowadays and

64
00:02:31,750 --> 00:02:29,440
guess what

65
00:02:33,030 --> 00:02:31,760
one of those planets in this image may

66
00:02:35,430 --> 00:02:33,040
have somebody

67
00:02:37,589 --> 00:02:35,440
like you or me or some other intelligent

68
00:02:39,270 --> 00:02:37,599
life form that we don't even know about

69
00:02:41,589 --> 00:02:39,280
yet so we got to keep searching we gotta

70
00:02:44,550 --> 00:02:41,599
we gotta tell that story you know

71
00:02:46,630 --> 00:02:44,560
the deep in hubble deep field refers to

72
00:02:49,190 --> 00:02:46,640
the telescope's ability to look at some

73
00:02:51,430 --> 00:02:49,200
of these far faint objects

74
00:02:53,509 --> 00:02:51,440
looking at far away objects in space is

75
00:02:55,910 --> 00:02:53,519
like seeing back in time

76
00:02:57,830 --> 00:02:55,920
light moves at tremendous speeds but it

77
00:02:59,670 --> 00:02:57,840
still takes time to travel across the

78
00:03:01,830 --> 00:02:59,680
vastness of space

79
00:03:04,390 --> 00:03:01,840
even the light from our own sun needs 8

80
00:03:06,470 --> 00:03:04,400
minutes and 20 seconds to reach earth

81
00:03:08,309 --> 00:03:06,480
so when we look at the sun we see it as

82
00:03:10,790 --> 00:03:08,319
it was a little more than eight minutes

83
00:03:13,430 --> 00:03:10,800
earlier the farther away the object the

84
00:03:15,589 --> 00:03:13,440
younger it appears in hubble's eyes

85
00:03:18,070 --> 00:03:15,599
the deep field was like a core sample of

86
00:03:20,390 --> 00:03:18,080
space showing galaxies at different and

87
00:03:22,550 --> 00:03:20,400
earlier stages of development the deeper

88
00:03:24,390 --> 00:03:22,560

they appeared in the image

89
00:03:26,869 --> 00:03:24,400
science and astronomy is all about

90
00:03:28,869 --> 00:03:26,879
honing and improving our senses

91
00:03:31,030 --> 00:03:28,879
no one expected the hubble deep field to

92
00:03:32,710 --> 00:03:31,040
have thousands of galaxies in that

93
00:03:33,910 --> 00:03:32,720
single image

94
00:03:35,030 --> 00:03:33,920
we thought

95
00:03:37,190 --> 00:03:35,040
x

96
00:03:38,630 --> 00:03:37,200
and we were so wrong

97
00:03:40,470 --> 00:03:38,640
and that experiment it took great

98
00:03:42,630 --> 00:03:40,480
engineering to do with a great system

99
00:03:45,670 --> 00:03:42,640
hubble allowed the astrophysics to say

100
00:03:47,990 --> 00:03:45,680
hold it you know it's different it

101
00:03:51,030 --> 00:03:48,000
helped connect the dark energy dark

102
00:03:53,429 --> 00:03:51,040
matter theories to what the light we can

103
00:03:55,429 --> 00:03:53,439
see is and for me it's it's beautiful

104
00:03:58,710 --> 00:03:55,439
because it's it's like looking into a

105
00:04:01,589 --> 00:03:58,720
pond and seeing the water molecules and

106
00:04:03,350 --> 00:04:01,599
the living cells that are micron around

107
00:04:05,030 --> 00:04:03,360
of the microbes

108
00:04:07,030 --> 00:04:05,040
it's like that kind of

109
00:04:09,030 --> 00:04:07,040
moment it must have been like the early

110
00:04:11,110 --> 00:04:09,040
microscopists who first looked at pond

111
00:04:13,589 --> 00:04:11,120
scum and said geez there's stuff going

112
00:04:16,069 --> 00:04:13,599
on or galileo when he first sensed the

113
00:04:18,150 --> 00:04:16,079

satellites of jupiter since the original

114
00:04:20,629 --> 00:04:18,160
hubble deep field hubble has gone on to

115
00:04:22,870 --> 00:04:20,639
collect over 20 deep fields of various

116
00:04:24,070 --> 00:04:22,880
parts of the sky in multiple wavelengths

117
00:04:26,550 --> 00:04:24,080
of light

118
00:04:29,110 --> 00:04:26,560
to create each image it is gazed at the

119
00:04:31,830 --> 00:04:29,120
same point in space for many orbits

120
00:04:33,749 --> 00:04:31,840
gathering as much light as it can

121
00:04:35,749 --> 00:04:33,759
every single one of these increased our

122
00:04:37,110 --> 00:04:35,759
knowledge of the universe and our place

123
00:04:39,350 --> 00:04:37,120
in it

124
00:04:42,550 --> 00:04:39,360
the hubble ultra deep field for instance

125
00:04:45,110 --> 00:04:42,560
released in 2004 had a longer exposure

126
00:04:47,030 --> 00:04:45,120
time than the previous deep field this

127
00:04:49,670 --> 00:04:47,040
new snapshot contained even more

128
00:04:51,270 --> 00:04:49,680
galaxies of various ages sizes shapes

129
00:04:53,350 --> 00:04:51,280
and colors

130
00:04:55,510 --> 00:04:53,360
the smallest reddest galaxies may be

131
00:04:57,749 --> 00:04:55,520
among the most distant known existing

132
00:04:59,909 --> 00:04:57,759
when the universe was just 800 million

133
00:05:02,150 --> 00:04:59,919
years old

134
00:05:04,629 --> 00:05:02,160
when i stare at that image

135
00:05:07,110 --> 00:05:04,639
my imagination goes wild i wonder what

136
00:05:08,710 --> 00:05:07,120
it would be like to visit any one of

137
00:05:09,830 --> 00:05:08,720
those little smudges of light which

138
00:05:11,909 --> 00:05:09,840

would be

139
00:05:15,110 --> 00:05:11,919
presumably possibly similar to our own

140
00:05:17,510 --> 00:05:15,120
milky way galaxy and also realizing that

141
00:05:19,749 --> 00:05:17,520
if we extrapolate that image to the

142
00:05:21,590 --> 00:05:19,759
whole sky that's what our universe looks

143
00:05:24,629 --> 00:05:21,600
like in any direction we see a

144
00:05:27,350 --> 00:05:24,639
collection of galaxies like that

145
00:05:29,510 --> 00:05:27,360
the width of the hubble ultra deep field

146
00:05:30,870 --> 00:05:29,520
is less than one tenth the diameter of

147
00:05:32,550 --> 00:05:30,880
the full moon

148
00:05:35,189 --> 00:05:32,560
that's like looking through the eye of a

149
00:05:38,310 --> 00:05:35,199
needle held at arm's length

150
00:05:40,950 --> 00:05:38,320
and in that tiny space we found ten

151
00:05:44,150 --> 00:05:40,960
thousand galaxies

152
00:05:46,870 --> 00:05:44,160
space

153
00:05:48,950 --> 00:05:46,880
ten thousand galaxies in that one too

154
00:05:50,950 --> 00:05:48,960
ten thousand galaxies there and ten

155
00:05:57,270 --> 00:05:50,960
thousand galaxies there

156
00:05:59,909 --> 00:05:57,280
if you add them all up that means the

157
00:06:04,469 --> 00:05:59,919
entire observable universe is estimated

158
00:06:06,870 --> 00:06:04,479
to contain at least 200 billion galaxies

159
00:06:09,110 --> 00:06:06,880
200 billion galaxies

160
00:06:11,510 --> 00:06:09,120
if each galaxy has an average of a

161
00:06:14,150 --> 00:06:11,520
hundred million stars in it then that

162
00:06:17,029 --> 00:06:14,160
means there are at least 20 quintillion

163
00:06:21,590 --> 00:06:17,039

stars in the observable universe that's

164
00:06:24,150 --> 00:06:21,600
a 2 with 19 zeros after it

165
00:06:26,629 --> 00:06:24,160
it makes me uh of course just

166
00:06:27,670 --> 00:06:26,639
overwhelmed but also just very curious

167
00:06:29,189 --> 00:06:27,680
about

168
00:06:30,390 --> 00:06:29,199
wouldn't wouldn't it be wonderful if i

169
00:06:31,909 --> 00:06:30,400
could just

170
00:06:33,670 --> 00:06:31,919
beam myself over to one of those

171
00:06:35,430 --> 00:06:33,680
galaxies and explore around and see if

172
00:06:37,029 --> 00:06:35,440
they have stars and planets like we have

173
00:06:39,590 --> 00:06:37,039
in our own milky way

174
00:06:40,870 --> 00:06:39,600
and just to just be amazed

175
00:06:43,430 --> 00:06:40,880
not only at the magnitude of the

176
00:06:45,830 --> 00:06:43,440
universe but to be grateful that i can

177
00:06:47,590 --> 00:06:45,840
be a part of the universe and have the

178
00:06:50,550 --> 00:06:47,600
ability to look out and see this

179
00:06:52,150 --> 00:06:50,560
grandeur that's what i love about the

180
00:06:55,749 --> 00:06:52,160
the ultra deep field and that's what i

181
00:06:58,230 --> 00:06:55,759
love about astronomy images in general

182
00:07:00,390 --> 00:06:58,240
inspired by hubble's deep field other

183
00:07:02,309 --> 00:07:00,400
nasa great observatories would go on to

184
00:07:04,070 --> 00:07:02,319
take deep field images in their own

185
00:07:06,469 --> 00:07:04,080
wavelengths of light

186
00:07:09,589 --> 00:07:06,479
these observations continue to make nasa

187
00:07:11,670 --> 00:07:09,599
science even richer than before

188
00:07:13,830 --> 00:07:11,680

the hubble space telescope has helped us

189
00:07:16,469 --> 00:07:13,840
take a step forward in understanding our

190
00:07:18,870 --> 00:07:16,479
place in the universe with hubble's

191
00:07:21,350 --> 00:07:18,880
mirror acting as our eyes we are just

192
00:07:23,110 --> 00:07:21,360
starting to perceive the real universe

193
00:07:25,110 --> 00:07:23,120
and the deep field images are yet

194
00:07:27,510 --> 00:07:25,120
another step forward to a brighter

195
00:07:29,270 --> 00:07:27,520
tomorrow

196
00:07:31,749 --> 00:07:29,280
the image itself might not look as

197
00:07:34,150 --> 00:07:31,759
beautiful as a single spiral galaxy

198
00:07:36,150 --> 00:07:34,160
where you see all the stars

199
00:07:38,950 --> 00:07:36,160
but what you're looking at is a tiny

200
00:07:41,350 --> 00:07:38,960
little part of the sky and they found

201
00:07:42,710 --> 00:07:41,360
thousands of galaxies in that tiny

202
00:07:44,390 --> 00:07:42,720
little spot

203
00:07:46,070 --> 00:07:44,400
and so you see this image

204
00:07:47,670 --> 00:07:46,080
and the ones that are a little closer to

205
00:07:48,629 --> 00:07:47,680
us you can see some detail on you can

206
00:07:50,710 --> 00:07:48,639
actually see that they're spiral

207
00:07:52,309 --> 00:07:50,720
galaxies or kind of blobby elliptical

208
00:07:54,070 --> 00:07:52,319
galaxies they're actually beautiful

209
00:07:55,430 --> 00:07:54,080
little galaxies and of themselves of

210
00:07:57,029 --> 00:07:55,440
course they're not little they're just

211
00:07:58,710 --> 00:07:57,039
very far away

212
00:08:00,790 --> 00:07:58,720
but then you see this background which

213
00:08:03,270 --> 00:08:00,800

really just becomes dots

214
00:08:04,230 --> 00:08:03,280
and and each one of those dots is not a

215
00:08:06,309 --> 00:08:04,240
star

216
00:08:08,309 --> 00:08:06,319
but a collection of hundreds of billions

217
00:08:10,070 --> 00:08:08,319
of stars just so far away that it

218
00:08:11,990 --> 00:08:10,080
appears as a dot

219
00:08:14,230 --> 00:08:12,000
and and some of the smaller dots in that

220
00:08:15,510 --> 00:08:14,240
image you're looking at galaxies as they

221
00:08:18,550 --> 00:08:15,520
were

222
00:08:19,670 --> 00:08:18,560
you know more than 10 11 billion years

223
00:08:21,990 --> 00:08:19,680
ago

224
00:08:23,749 --> 00:08:22,000
in this tiny little dot in the sky

225
00:08:26,230 --> 00:08:23,759
you can look through it and you can see

226
00:08:27,909 --> 00:08:26,240
the history of the whole universe

227
00:08:29,830 --> 00:08:27,919
and so when you see the hubble deep

228
00:08:31,270 --> 00:08:29,840
field you know i can feel you know the

229
00:08:32,709 --> 00:08:31,280
hair rising on the back of my neck and

230
00:08:34,070 --> 00:08:32,719
i'm getting goosebumps even just

231
00:08:37,029 --> 00:08:34,080
thinking about it

232
00:08:38,149 --> 00:08:37,039
you know through a tiny little pinhole

233
00:08:39,909 --> 00:08:38,159
you can see the whole history of the

234
00:08:42,790 --> 00:08:39,919
universe right there that's the hubble

235
00:08:42,800 --> 00:08:45,950
wow

236
00:08:45,960 --> 00:09:24,550
[Music]

237
00:09:24,560 --> 00:09:32,460
so

238
00:09:35,730 --> 00:09:34,650

[Music]

239
00:09:36,280 --> 00:09:35,740
[Applause]