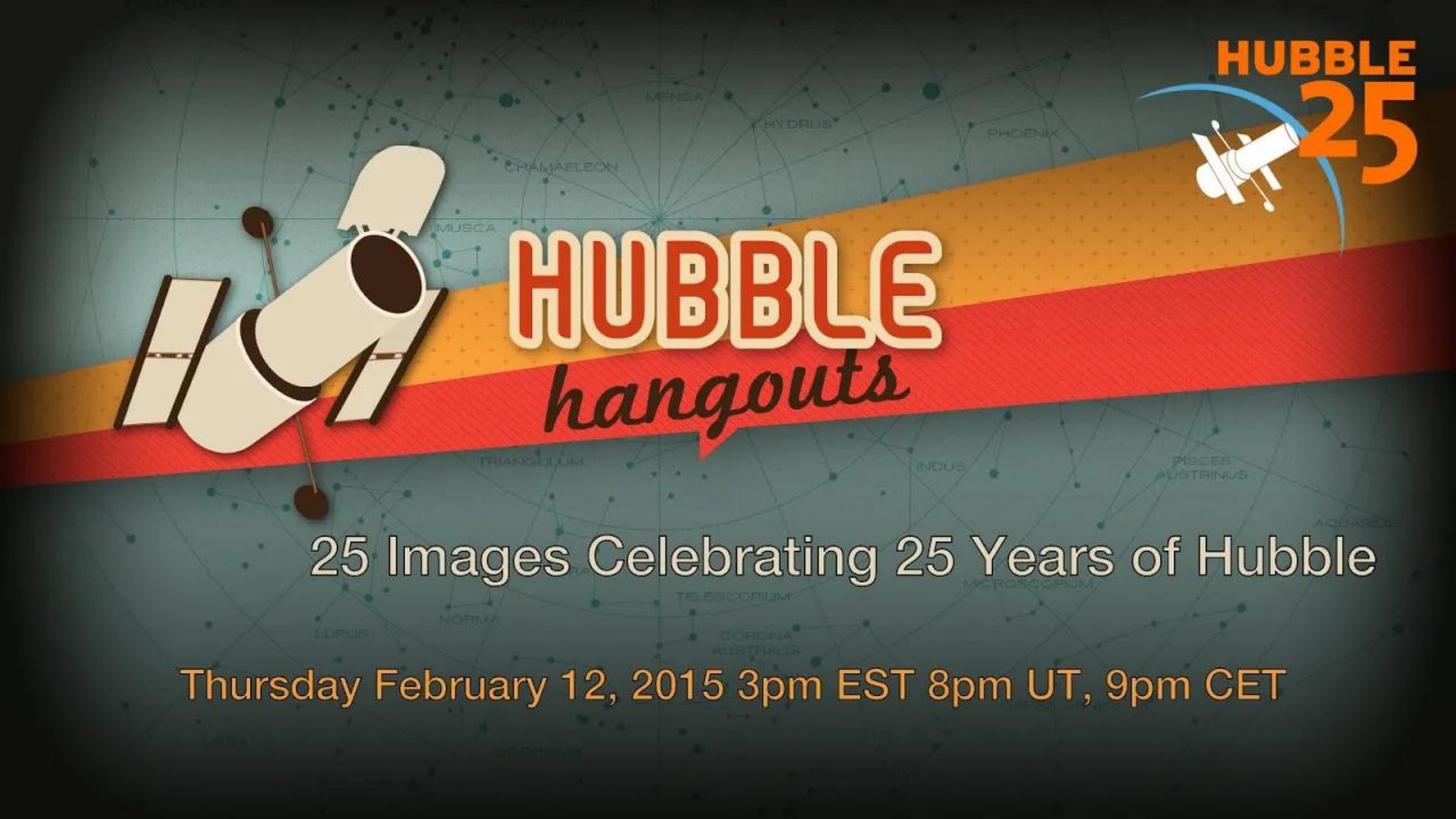
HUBBLE 25
HUBBLE
hangouts
25 Images Celebrating 25 Years of Hubble
Thursday February 12, 2015 3pm EST 8pm UT, 9pm CET

1
00:00:05,420 --> 00:00:03,230
hello everybody and welcome to this

2
00:00:06,680 --> 00:00:05,430
week's Hubbell hangout my name is Tony

3
00:00:09,080 --> 00:00:06,690
Darnell I work at the Space Telescope

4
00:00:10,549 --> 00:00:09,090
Science Institute and we have a really

5
00:00:13,610 --> 00:00:10,559
great hangout plan for you today we're

6
00:00:15,919 --> 00:00:13,620
going to continue our celebration of the

7
00:00:19,010 --> 00:00:15,929
25 years of hubble space telescope being

8
00:00:22,580 --> 00:00:19,020
in orbit and we are going to show you

9
00:00:25,370 --> 00:00:22,590
our all mic what we're calling the micro

10
00:00:27,650 --> 00:00:25,380
site which is sort of the central hub of

11
00:00:30,950 --> 00:00:27,660
all things Hubbell 25 and we're also

12
00:00:32,510 --> 00:00:30,960
going to show you 25 of what we consider

13
00:00:35,209 --> 00:00:32,520

to be some of the most representative

14
00:00:36,680 --> 00:00:35,219
images of not just the science of Hubble

15
00:00:38,119 --> 00:00:36,690
but also some of the images that

16
00:00:40,369 --> 00:00:38,129
illustrate some of the beauty of the

17
00:00:43,010 --> 00:00:40,379
universe as well and so with me to talk

18
00:00:44,959 --> 00:00:43,020
about that is not as they are with me

19
00:00:48,069 --> 00:00:44,969
every week is dr. Carol Christian

20
00:00:51,200 --> 00:00:48,079
she's outreach scientist and Scott Lewis

21
00:00:57,350 --> 00:00:51,210
Esquire the third no the third Esquire

22
00:00:58,910 --> 00:00:57,360
Wow keeps going I love this yeah just

23
00:01:02,799 --> 00:00:58,920
call me the Lord of the Internet and

24
00:01:06,140 --> 00:01:02,809
that's fine I know from know the cosmos

25
00:01:07,969 --> 00:01:06,150
so the this week's format's a little bit

26
00:01:09,320 --> 00:01:07,979
different because it's just gonna be the

27
00:01:12,320 --> 00:01:09,330
three of us talking about these things

28
00:01:14,630 --> 00:01:12,330
so we really want you this is your great

29
00:01:16,460 --> 00:01:14,640
chance for you to ask us questions leave

30
00:01:20,330 --> 00:01:16,470
us comments the best way to do that's

31
00:01:21,859 --> 00:01:20,340
with the Q&A app on Google+ or the the

32
00:01:23,510 --> 00:01:21,869
video that you're watching this on I

33
00:01:25,580 --> 00:01:23,520
think it's also on YouTube as well and

34
00:01:27,649 --> 00:01:25,590
you can comment on the YouTube channel

35
00:01:30,200 --> 00:01:27,659
this is being broadcast on as long as

36
00:01:31,910 --> 00:01:30,210
well as the Google+ event page we're

37
00:01:33,620 --> 00:01:31,920
looking at all these things so I'm

38
00:01:35,600 --> 00:01:33,630

already seeing Tony Lynn she's giving us

39
00:01:38,120 --> 00:01:35,610
a hi and Michael Jobin giving us a

40
00:01:40,910 --> 00:01:38,130
exclamation point so keep them coming

41
00:01:43,999 --> 00:01:40,920
folks and we'll get to them as we step

42
00:01:46,210 --> 00:01:44,009
through the program so let's get started

43
00:01:48,830 --> 00:01:46,220
so Carol we are in the process of

44
00:01:51,080 --> 00:01:48,840
celebrating the 25 years of the Hubble

45
00:01:55,550 --> 00:01:51,090
Space Telescope when we've made this

46
00:01:59,630 --> 00:01:55,560
thing called the micro site let me let

47
00:02:08,320 --> 00:01:59,640
me share my screen and put this you get

48
00:02:13,460 --> 00:02:11,240
twenty five th dot o-r-g

49
00:02:16,070 --> 00:02:13,470
and this is where we are putting

50
00:02:19,040 --> 00:02:16,080
everything that we all of our content

51
00:02:21,350 --> 00:02:19,050
will be highlighted here on this spot so

52
00:02:24,230 --> 00:02:21,360
it's it's relatively new we just went

53
00:02:25,730 --> 00:02:24,240
live at the double-a s in January so

54
00:02:28,640 --> 00:02:25,740
it's been up about a month a little bit

55
00:02:31,610 --> 00:02:28,650
later a little bit longer and as you can

56
00:02:33,350 --> 00:02:31,620
see it's you know it's it's right now

57
00:02:34,640 --> 00:02:33,360
I've got a big banner up here we've got

58
00:02:36,650 --> 00:02:34,650
some things along the side that we're

59
00:02:37,850 --> 00:02:36,660
gonna get to each one of these but if

60
00:02:40,490 --> 00:02:37,860
you're interested in finding out about

61
00:02:43,430 --> 00:02:40,500
news things that are coming up this is

62
00:02:47,480 --> 00:02:43,440
where you would go on March 7th there's

63
00:02:48,770 --> 00:02:47,490

gonna be a Symphony Orchestra concert at

64
00:02:50,570 --> 00:02:48,780
in Baltimore

65
00:02:52,580 --> 00:02:50,580
so all of these things are gonna be

66
00:02:54,110 --> 00:02:52,590
listed here our hangout from today is

67
00:02:56,449 --> 00:02:54,120
right up here as well so you would have

68
00:02:58,490 --> 00:02:56,459
learned about our hangout from here if

69
00:02:59,900 --> 00:02:58,500
you don't subscribe to our stuff so

70
00:03:01,699 --> 00:02:59,910
these are some of the things then down

71
00:03:02,690 --> 00:03:01,709
it down at the bottom we have our Flickr

72
00:03:04,130 --> 00:03:02,700
stream and we're gonna I'm going to come

73
00:03:05,390 --> 00:03:04,140
back to this because that's gonna be the

74
00:03:07,970 --> 00:03:05,400
highlight of most of what we talked

75
00:03:10,880 --> 00:03:07,980
about and then below that a little bit

76
00:03:13,520 --> 00:03:10,890
about the mission itself right the just

77
00:03:15,410 --> 00:03:13,530
a brief summary of what Hubble is and

78
00:03:17,060 --> 00:03:15,420
how it was deployed and when it was

79
00:03:18,650 --> 00:03:17,070
launched and all that kind of stuff and

80
00:03:21,470 --> 00:03:18,660
then we have these other things across

81
00:03:22,940 --> 00:03:21,480
the top here we got one call got a tab

82
00:03:25,280 --> 00:03:22,950
called science and when you click on

83
00:03:27,560 --> 00:03:25,290
that what do you see Carol what is this

84
00:03:31,360 --> 00:03:27,570
what is this page designed for so this

85
00:03:35,570 --> 00:03:31,370
page talks about the the basic topics of

86
00:03:37,400 --> 00:03:35,580
that Hubble covers and some people are

87
00:03:41,090 --> 00:03:37,410
surprised that we actually do solar

88
00:03:43,400 --> 00:03:41,100

system science but we do and I think

89
00:03:46,580 --> 00:03:43,410
everybody knows we do extrasolar planets

90
00:03:48,440 --> 00:03:46,590
and then bread-and-butter stars and

91
00:03:50,600 --> 00:03:48,450
nebulae galaxies and then of course the

92
00:03:54,110 --> 00:03:50,610
universe so we we cover all of those

93
00:03:57,340 --> 00:03:54,120
topics from the ultraviolet to the

94
00:04:01,370 --> 00:03:57,350
infrared and this is just to introduce

95
00:04:03,440 --> 00:04:01,380
the user to some of the science topics

96
00:04:05,560 --> 00:04:03,450
that have been covered highlights of the

97
00:04:10,520 --> 00:04:05,570
science topics that have been covered

98
00:04:12,080 --> 00:04:10,530
and I didn't I knew some of the solar

99
00:04:13,610 --> 00:04:12,090
system science but actually at the

100
00:04:15,580 --> 00:04:13,620
double-a s we talked through that and

101
00:04:18,770 --> 00:04:15,590
there there really has really done some

102
00:04:21,080 --> 00:04:18,780
exciting things which it's hard to

103
00:04:22,820 --> 00:04:21,090
observe solar system objects with humble

104
00:04:25,520 --> 00:04:22,830
it's tricky but we've done some

105
00:04:29,160 --> 00:04:25,530
interesting things so

106
00:04:32,490 --> 00:04:29,170
yeah I'm these on these topics yeah

107
00:04:34,140 --> 00:04:32,500
just last week yeah so in down at the

108
00:04:36,390 --> 00:04:34,150
bottom there are links also that there's

109
00:04:40,650 --> 00:04:36,400
gonna be articles as throughout the year

110
00:04:43,860 --> 00:04:40,660
as either new press releases come out or

111
00:04:45,330 --> 00:04:43,870
new stories come out so you want to

112
00:04:46,500 --> 00:04:45,340
check with these different sections if

113
00:04:49,170 --> 00:04:46,510

you click on some of these links like

114
00:04:50,850 --> 00:04:49,180
this comet Ison breakup we'll take you

115
00:04:53,490 --> 00:04:50,860
to Hubble site so it'll gets a link that

116
00:04:55,140 --> 00:04:53,500
goes to Hubble site and you can you know

117
00:04:57,060 --> 00:04:55,150
read the read about some of the articles

118
00:04:59,040 --> 00:04:57,070
that we have there

119
00:05:01,260 --> 00:04:59,050
so there's a lot we're gonna try and

120
00:05:03,660 --> 00:05:01,270
really be as thorough as we can because

121
00:05:05,520 --> 00:05:03,670
there's so much Hubble stuff that you

122
00:05:06,870 --> 00:05:05,530
can that you can learn about everything

123
00:05:08,940 --> 00:05:06,880
going on and what Hubble has done in the

124
00:05:10,500 --> 00:05:08,950
various areas now in the terms of

125
00:05:12,480 --> 00:05:10,510
extrasolar planets though Carol this is

126
00:05:14,550 --> 00:05:12,490
a pretty new area in which in which

127
00:05:18,000 --> 00:05:14,560
Hubble has been contributing isn't it it

128
00:05:21,030 --> 00:05:18,010
is and it wasn't really for seeing that

129
00:05:23,130 --> 00:05:21,040
as much that the couple would produce as

130
00:05:25,080 --> 00:05:23,140
much as it did and the interesting thing

131
00:05:28,470 --> 00:05:25,090
is that even before Kepler was launched

132
00:05:31,200 --> 00:05:28,480
Hubble had done a transit it has looked

133
00:05:34,530 --> 00:05:31,210
of course famously at the debris disks

134
00:05:37,170 --> 00:05:34,540
and still looking at debris disks from a

135
00:05:40,440 --> 00:05:37,180
couple of you know famous cases but also

136
00:05:42,210 --> 00:05:40,450
there's a lot more going on getting data

137
00:05:44,250 --> 00:05:42,220
from the archive and really picking

138
00:05:46,380 --> 00:05:44,260

through it and finding out all the

139
00:05:47,700 --> 00:05:46,390
details of debris disc and then trying

140
00:05:51,510 --> 00:05:47,710
to understand the relationship between

141
00:05:54,810 --> 00:05:51,520
debris disks and planet formation and

142
00:05:57,300 --> 00:05:54,820
then there have been a few studies of

143
00:06:00,210 --> 00:05:57,310
actually atmospheres so that's a little

144
00:06:02,430 --> 00:06:00,220
bit of a preview to what James Webb will

145
00:06:04,410 --> 00:06:02,440
be able to do on extrasolar planets and

146
00:06:06,800 --> 00:06:04,420
of course is related to things that

147
00:06:09,690 --> 00:06:06,810
other orbiting and ground-based

148
00:06:11,550 --> 00:06:09,700
telescopes do regarding extrasolar

149
00:06:13,500 --> 00:06:11,560
planets so right so yeah and so that's

150
00:06:14,820 --> 00:06:13,510
just you know that so this is where most

151
00:06:16,110 --> 00:06:14,830
of the science will be highlighted

152
00:06:19,920 --> 00:06:16,120
that's the science tab so you can check

153
00:06:21,810 --> 00:06:19,930
all that out the images area I in April

154
00:06:24,030 --> 00:06:21,820
we're going to be up we're going to be

155
00:06:27,120 --> 00:06:24,040
unveiling the actual Hubble anniversary

156
00:06:29,700 --> 00:06:27,130
image now we did unveil an image double

157
00:06:31,950 --> 00:06:29,710
a s but that was not the image and are

158
00:06:34,110 --> 00:06:31,960
these are these past Hubble anniversary

159
00:06:36,620 --> 00:06:34,120
images some of them are okay some of

160
00:06:38,330 --> 00:06:36,630
them are not all but some are yeah

161
00:06:40,700 --> 00:06:38,340
okay so that's what we've gathered a lot

162
00:06:42,860 --> 00:06:40,710
of those up there's some videos that are

163
00:06:45,730 --> 00:06:42,870

being created one of our video producers

164
00:06:50,540 --> 00:06:45,740
in-house every month is going to be

165
00:06:51,860 --> 00:06:50,550
producing a Hubble themed video and the

166
00:06:53,780 --> 00:06:51,870
first one has already created it's

167
00:06:55,370 --> 00:06:53,790
called the beginning and you can watch

168
00:06:57,200 --> 00:06:55,380
them here they're also posted on our

169
00:06:59,740 --> 00:06:57,210
YouTube page our YouTube channel the

170
00:07:04,160 --> 00:06:59,750
next one should be out this month soon

171
00:07:06,830 --> 00:07:04,170
and so the idea is to is to put them out

172
00:07:07,910 --> 00:07:06,840
once per month is it for every month of

173
00:07:11,630 --> 00:07:07,920
the year or just leading up to the

174
00:07:13,850 --> 00:07:11,640
anniversary the anniversary and I mean

175
00:07:16,160 --> 00:07:13,860
she's really uncovered some interesting

176
00:07:20,030 --> 00:07:16,170
information but also some interesting

177
00:07:23,920 --> 00:07:20,040
people and she found somebody who's very

178
00:07:26,570 --> 00:07:23,930
old but she found him and he knew Hubble

179
00:07:29,510 --> 00:07:26,580
so she did get an interview with him

180
00:07:31,220 --> 00:07:29,520
he's like 95 anyway she has interviewed

181
00:07:33,830 --> 00:07:31,230
some really interesting people in

182
00:07:36,440 --> 00:07:33,840
connection with this she's done a

183
00:07:39,620 --> 00:07:36,450
wonderful job on these videos they're

184
00:07:41,360 --> 00:07:39,630
really yeah we're who we're talking

185
00:07:43,310 --> 00:07:41,370
abouts Marion Stacy oh and she also does

186
00:07:45,860 --> 00:07:43,320
behind the web it's another video series

187
00:07:47,660 --> 00:07:45,870
that she's also doing so that's look

188
00:07:49,040 --> 00:07:47,670

there you'll see about that all the

189
00:07:53,090 --> 00:07:49,050
videos will be posted here as well

190
00:07:54,890 --> 00:07:53,100
there's an explore section these are

191
00:07:56,600 --> 00:07:54,900
resources I guess we got for students

192
00:07:59,840 --> 00:07:56,610
and educators so if you're a teacher and

193
00:08:02,120 --> 00:07:59,850
you know we're just a regular astronomy

194
00:08:04,310 --> 00:08:02,130
fan you can get a lot of information

195
00:08:06,770 --> 00:08:04,320
here information about careers what it's

196
00:08:08,210 --> 00:08:06,780
like meet some of the people there some

197
00:08:11,690 --> 00:08:08,220
of the discoveries this is a really cool

198
00:08:13,520 --> 00:08:11,700
section here with the different images

199
00:08:15,440 --> 00:08:13,530
and facts about Hubble there's a Q&A

200
00:08:17,600 --> 00:08:15,450
that quick questions students have asked

201
00:08:19,610 --> 00:08:17,610
over the years there's also submit a

202
00:08:23,150 --> 00:08:19,620
misconceptions section what's this about

203
00:08:24,440 --> 00:08:23,160
Carol do you miss versus reality right I

204
00:08:29,300 --> 00:08:24,450
mean there's a lot of things that people

205
00:08:30,920 --> 00:08:29,310
people like one of the paid yeah yeah

206
00:08:34,940 --> 00:08:30,930
the Hubble Space Telescope was a man

207
00:08:36,920 --> 00:08:34,950
satellite with astronauts living that

208
00:08:41,719 --> 00:08:36,930
might have been a plane a long time ago

209
00:08:43,730 --> 00:08:41,729
no I still love that concept art that

210
00:08:48,939 --> 00:08:43,740
I've seen for it were they did it yeah

211
00:08:53,389 --> 00:08:51,470
amazing and then other things like I

212
00:08:56,389 --> 00:08:53,399
mean the next one is a common thing is

213
00:08:57,019 --> 00:08:56,399

that Hubble sees better because it's

214
00:08:59,449 --> 00:08:57,029
closer

215
00:09:01,220 --> 00:08:59,459
no it's by the earth its orbits the

216
00:09:05,090 --> 00:09:01,230
earth and people and some people think

217
00:09:07,129 --> 00:09:05,100
that Hubble who and they need they will

218
00:09:09,170 --> 00:09:07,139
learn by asking the question that the

219
00:09:11,600 --> 00:09:09,180
universe is very vast and Hubble cannot

220
00:09:14,869 --> 00:09:11,610
go to a place and take a picture so it's

221
00:09:17,840 --> 00:09:14,879
in orbit around the Earth and it it is

222
00:09:19,699 --> 00:09:17,850
controlled from down here and we pointed

223
00:09:21,319 --> 00:09:19,709
much as we do ground-based telescopes

224
00:09:23,720 --> 00:09:21,329
and the reason it sees so clearly is

225
00:09:27,530 --> 00:09:23,730
because it's above the atmosphere which

226
00:09:29,929 --> 00:09:27,540
causes blurring of images so there are

227
00:09:33,470 --> 00:09:29,939
things like that that come up all the

228
00:09:41,920 --> 00:09:33,480
time and so they want to nestle as work

229
00:09:44,329 --> 00:09:41,930
Drive technology so yeah but I'm holding

230
00:09:46,759 --> 00:09:44,339
Elon Musk and I have been you know

231
00:09:48,710 --> 00:09:46,769
keeping it under wraps for a loan

232
00:09:50,809 --> 00:09:48,720
find out how we're really going to start

233
00:09:52,369 --> 00:09:50,819
doing this yeah and the final section

234
00:09:54,410 --> 00:09:52,379
here that I think is among the most

235
00:09:56,179 --> 00:09:54,420
important are where you can learn about

236
00:09:58,929 --> 00:09:56,189
things that are going on related to

237
00:10:04,869 --> 00:09:58,939
Hubble 25 that are not necessarily

238
00:10:13,449 --> 00:10:10,519

sorry I just got a text yeah yes all

239
00:10:15,829 --> 00:10:13,459
over the place and so for example our

240
00:10:18,379 --> 00:10:15,839
there's a talk today in San Jose

241
00:10:23,119 --> 00:10:18,389
California about Hubble 25 years of

242
00:10:25,189 --> 00:10:23,129
imaging the cosmos and the our hangout

243
00:10:27,860 --> 00:10:25,199
is right here also today so that's also

244
00:10:30,019 --> 00:10:27,870
listed so and the hangout from yesterday

245
00:10:32,929 --> 00:10:30,029
with I did with Frank about his news

246
00:10:34,790 --> 00:10:32,939
from Hubble so all of the events are you

247
00:10:37,129 --> 00:10:34,800
are gonna be listed here as they become

248
00:10:40,040 --> 00:10:37,139
known so and I know there are people who

249
00:10:42,379 --> 00:10:40,050
who have decided to as we talk about the

250
00:10:45,559 --> 00:10:42,389
images have decided to use the images

251
00:10:47,119 --> 00:10:45,569
and make small presentations locally and

252
00:10:49,639 --> 00:10:47,129
it would be great if they would tell us

253
00:10:52,549 --> 00:10:49,649
about that because then we could

254
00:10:55,280 --> 00:10:52,559
advertise that on this page and then

255
00:10:57,259 --> 00:10:55,290
people who are local to that museum or

256
00:10:58,400 --> 00:10:57,269
library or whatever could go there as

257
00:11:01,389 --> 00:10:58,410
well I know there's these

258
00:11:04,460 --> 00:11:01,399
pockets of these things going on that

259
00:11:05,660 --> 00:11:04,470
maybe we don't know about yeah now this

260
00:11:07,699 --> 00:11:05,670
one looks really cool if you're gonna be

261
00:11:09,590 --> 00:11:07,709
in New York on April 30th Sara Seager

262
00:11:11,269 --> 00:11:09,600
Adam Reese and those guys are going to

263
00:11:12,710 --> 00:11:11,279

be giving a talk on Hubble and our

264
00:11:16,579 --> 00:11:12,720
altered universe that looks really good

265
00:11:18,949 --> 00:11:16,589
so anyway that's the webpage check it

266
00:11:22,249 --> 00:11:18,959
out if you want to learn about all

267
00:11:23,749 --> 00:11:22,259
things Hubble 25 related and if you have

268
00:11:26,720 --> 00:11:23,759
any suggestions or things that you think

269
00:11:29,509 --> 00:11:26,730
we should put up then by all means I'll

270
00:11:31,600 --> 00:11:29,519
let us know and we can say we can get

271
00:11:34,550 --> 00:11:31,610
try and get some stuff up there okay so

272
00:11:37,550 --> 00:11:34,560
I got a quick question here from Sofia

273
00:11:39,650 --> 00:11:37,560
Garcia on the QA app will they still use

274
00:11:42,170 --> 00:11:39,660
Hubble when James Webb Space Telescope

275
00:11:44,720 --> 00:11:42,180
is launched neither for from these are

276
00:11:47,389 --> 00:11:44,730
from students from Waukegan Illinois yes

277
00:11:49,879 --> 00:11:47,399
so the idea is to have the two

278
00:11:52,999 --> 00:11:49,889
telescopes in orbit at the same time and

279
00:11:57,579 --> 00:11:53,009
we do know that the James Webb is

280
00:11:59,689 --> 00:11:57,589
scheduled to launch in 2018 so about

281
00:12:05,059 --> 00:11:59,699
about three and a half years from now

282
00:12:07,879 --> 00:12:05,069
and we know that as long as all the

283
00:12:10,490 --> 00:12:07,889
equipment is working on Hubble that it

284
00:12:12,740 --> 00:12:10,500
will last at least until 2020 and then

285
00:12:15,710 --> 00:12:12,750
beyond so it will have at least two

286
00:12:17,329 --> 00:12:15,720
years of overlap and we certainly will

287
00:12:19,100 --> 00:12:17,339
keep it operating as long as all the

288
00:12:21,590 --> 00:12:19,110

equipment's working Hubble will continue

289
00:12:24,439 --> 00:12:21,600
to work years thereafter so then there

290
00:12:26,530 --> 00:12:24,449
may be more than two years yeah then

291
00:12:29,300 --> 00:12:26,540
that'll be that'll be an extraordinary

292
00:12:30,800 --> 00:12:29,310
both where both of us do where both the

293
00:12:33,460 --> 00:12:30,810
telescope's are up and operating so

294
00:12:36,949 --> 00:12:33,470
thank you from Waukegan that was awesome

295
00:12:38,329 --> 00:12:36,959
Ashley nll is asking what is the URL of

296
00:12:40,280 --> 00:12:38,339
the site you are showing here it's

297
00:12:42,139 --> 00:12:40,290
blurry and I cannot see the URL the URL

298
00:12:43,639 --> 00:12:42,149
is in the description box of the video

299
00:12:47,360 --> 00:12:43,649
you're watching so that's one place you

300
00:12:54,499 --> 00:12:47,370
can look but it's Hubble 25 th dot o-r-g

301
00:12:56,449 --> 00:12:54,509
Hubble twenty-fifth comments now in

302
00:12:58,280 --> 00:12:56,459
YouTube and Google+ so if you guys are

303
00:13:00,889 --> 00:12:58,290
watching this anywhere there I made sure

304
00:13:03,079 --> 00:13:00,899
it's in the comment section and Michael

305
00:13:14,600 --> 00:13:03,089
Chabon says we should say 25th with the

306
00:13:20,960 --> 00:13:17,660
okay all right let's move to the images

307
00:13:23,569 --> 00:13:20,970
themselves we've Carol among others was

308
00:13:26,389 --> 00:13:23,579
in a sort of a committee I guess to pick

309
00:13:32,900 --> 00:13:26,399
25 images what Carol let you decide I'll

310
00:13:34,939 --> 00:13:32,910
let you talk about what were you so the

311
00:13:37,369 --> 00:13:34,949
the idea was that we were as we were

312
00:13:40,429 --> 00:13:37,379
talking about the 25th anniversary we

313
00:13:43,639 --> 00:13:40,439

said you know we we should have when

314
00:13:46,489 --> 00:13:43,649
people say give us 25 images or what are

315
00:13:49,160 --> 00:13:46,499
the best 25 it's hard to choose the best

316
00:13:52,129 --> 00:13:49,170
or most significant or whatever so we

317
00:13:55,609 --> 00:13:52,139
decided to just sit down and and pick 25

318
00:13:58,309 --> 00:13:55,619
images that we thought were engaging

319
00:14:00,769 --> 00:13:58,319
images but also represented the science

320
00:14:03,410 --> 00:14:00,779
being done with Hubble some of them are

321
00:14:07,009 --> 00:14:03,420
anniversary images some of them are

322
00:14:08,929 --> 00:14:07,019
popular objects so we came up with this

323
00:14:11,299 --> 00:14:08,939
list we argued about it a little bit

324
00:14:14,299 --> 00:14:11,309
because there were so many and this does

325
00:14:16,309 --> 00:14:14,309
not mean that any of the other images

326
00:14:18,019 --> 00:14:16,319
are not good images these are just the

327
00:14:20,030 --> 00:14:18,029
ones we thought if you want to make a

328
00:14:23,150 --> 00:14:20,040
poster or whatever that we would

329
00:14:26,239 --> 00:14:23,160
concentrate on the descriptions and in

330
00:14:28,069 --> 00:14:26,249
the images area there is a a poster that

331
00:14:30,739 --> 00:14:28,079
you could print if you wanted to make a

332
00:14:32,840 --> 00:14:30,749
display of some or all of these they're

333
00:14:34,850 --> 00:14:32,850
print ready so you can print them and

334
00:14:37,999 --> 00:14:34,860
you could mount them in a school or

335
00:14:40,400 --> 00:14:38,009
wherever a library and they're all set

336
00:14:42,379 --> 00:14:40,410
and they have captions so we decided we

337
00:14:45,470 --> 00:14:42,389
should do that we can do that for all

338
00:14:47,720 --> 00:14:45,480

the images we've ever released but we

339
00:14:51,379 --> 00:14:47,730
thought we would do 25 for the 25th

340
00:14:52,939 --> 00:14:51,389
anniversary just real quick I wanted to

341
00:14:54,319 --> 00:14:52,949
mention then I forgot at the top of the

342
00:14:56,090 --> 00:14:54,329
Hangout to mention and we're also

343
00:14:57,289 --> 00:14:56,100
looking at the Hubble hangout hashtag on

344
00:14:59,150 --> 00:14:57,299
Twitter so if you want to comment that

345
00:15:02,239 --> 00:14:59,160
way you can as well alright so Scott can

346
00:15:04,429 --> 00:15:02,249
you Scott has because he is an Internet

347
00:15:06,859 --> 00:15:04,439
driver extraordinaire has as well who

348
00:15:08,869 --> 00:15:06,869
and gathered the images for us so that

349
00:15:11,210 --> 00:15:08,879
we can we could share them with you and

350
00:15:12,439 --> 00:15:11,220
he has he has organized them in the same

351
00:15:17,090 --> 00:15:12,449
way they're done on our Flickr stream

352
00:15:22,279 --> 00:15:17,100
now the Flickr stream on Hubble 25th at

353
00:15:26,420 --> 00:15:22,289
real fast it's right here at the bottom

354
00:15:28,130 --> 00:15:26,430
of the main page you go to you go to

355
00:15:30,710 --> 00:15:28,140
here at the bottom and there is a

356
00:15:32,450 --> 00:15:30,720
flicker stream and you can click on view

357
00:15:35,300 --> 00:15:32,460
Photo Stream and that is what Scott is

358
00:15:37,730 --> 00:15:35,310
showing it is in order of on the flicker

359
00:15:41,450 --> 00:15:37,740
stream it's an order of year starting

360
00:15:43,760 --> 00:15:41,460
from 1990 to the present so just so you

361
00:15:49,040 --> 00:15:43,770
know okay okay so Scott I've got you in

362
00:15:52,120 --> 00:15:49,050
bigand on so what we're looking at here

363
00:15:55,280 --> 00:15:52,130

this is the 1990 image of supernova

364
00:15:56,600 --> 00:15:55,290
1987a yeah Frank talked about this a

365
00:15:58,519 --> 00:15:56,610
little bit at the Hangout yesterday

366
00:16:06,260 --> 00:15:58,529
Carol do you have any comments on this

367
00:16:10,070 --> 00:16:06,270
one so 1987a is very interesting because

368
00:16:12,380 --> 00:16:10,080
it has been followed for so long

369
00:16:15,280 --> 00:16:12,390
actually with Hubble is it it's pretty

370
00:16:21,670 --> 00:16:15,290
fortuitous that we actually were able to

371
00:16:24,350 --> 00:16:21,680
observe it for so long so this image

372
00:16:26,060 --> 00:16:24,360
there are there are many images of it so

373
00:16:28,850 --> 00:16:26,070
this is just one of the ones which is

374
00:16:31,610 --> 00:16:28,860
very interesting but the idea was that

375
00:16:35,000 --> 00:16:31,620
as the explosion occurred there was a

376
00:16:37,390 --> 00:16:35,010
light light there was a material but

377
00:16:42,460 --> 00:16:37,400
there was also light that came out from

378
00:16:45,500 --> 00:16:42,470
from the supernova and it ended up

379
00:16:48,230 --> 00:16:45,510
lighting up this ring and over time

380
00:16:49,820 --> 00:16:48,240
different parts of this ring I mean at

381
00:16:52,250 --> 00:16:49,830
first glance it always looks like a ring

382
00:16:54,590 --> 00:16:52,260
but it has lit up the light has little

383
00:16:56,990 --> 00:16:54,600
as it hits from the exuberant explosion

384
00:16:58,160 --> 00:16:57,000
it's different parts of it and ionizes

385
00:17:02,090 --> 00:16:58,170
different parts of it and it's very

386
00:17:04,400 --> 00:17:02,100
clumpy so over time it's actually

387
00:17:07,669 --> 00:17:04,410
changed which is interesting to what

388
00:17:11,929 --> 00:17:07,679

this image is evocative of the whole

389
00:17:13,819 --> 00:17:11,939
event but the idea is that we've been

390
00:17:17,270 --> 00:17:13,829
watching it over a long period of time

391
00:17:21,910 --> 00:17:17,280
and the ring was actually a surprise

392
00:17:24,590 --> 00:17:21,920
because what it indicates we think of a

393
00:17:26,329 --> 00:17:24,600
supernova is being very catastrophic and

394
00:17:28,549 --> 00:17:26,339
what was a little bit of surprises that

395
00:17:31,610 --> 00:17:28,559
that ring was there and so as the light

396
00:17:34,070 --> 00:17:31,620
came out before the material came up

397
00:17:36,530 --> 00:17:34,080
with us the light came out from the

398
00:17:38,960 --> 00:17:36,540
explosion it hit this debris that was

399
00:17:40,100 --> 00:17:38,970
already around the star so the store had

400
00:17:42,320 --> 00:17:40,110
already done some

401
00:17:45,320 --> 00:17:42,330
maybe not so catastrophic but it had

402
00:17:47,360 --> 00:17:45,330
gotten rid of some material so the light

403
00:17:50,419 --> 00:17:47,370
came out and illuminated that ring and

404
00:17:52,880 --> 00:17:50,429
then slowly over time some of that

405
00:17:56,440 --> 00:17:52,890
material that came from the central star

406
00:17:59,000 --> 00:17:56,450
has come out and started to up

407
00:18:01,760 --> 00:17:59,010
interesting and it's one of the things

408
00:18:03,500 --> 00:18:01,770
there you know when I first took

409
00:18:05,150 --> 00:18:03,510
astronomy it was always ago things

410
00:18:06,890 --> 00:18:05,160
change over really long period of time

411
00:18:08,600 --> 00:18:06,900
and you'll never see changes and this is

412
00:18:12,110 --> 00:18:08,610
one of the things that actually does

413
00:18:13,760 --> 00:18:12,120

change quite a lot so it's knows me a

414
00:18:15,380 --> 00:18:13,770
way that back in the day we used to

415
00:18:17,870 --> 00:18:15,390
think that you did sky was just sort of

416
00:18:19,640 --> 00:18:17,880
static and and sort of an unchanging

417
00:18:22,159 --> 00:18:19,650
place but you know there's actually

418
00:18:26,090 --> 00:18:22,169
fields of study that measure transient

419
00:18:29,600 --> 00:18:26,100
events like supernovae eruptions or or

420
00:18:31,460 --> 00:18:29,610
you're watching I think you know

421
00:18:34,730 --> 00:18:31,470
different things rotate up and up in the

422
00:18:36,500 --> 00:18:34,740
sky so or one star passing in front of

423
00:18:38,180 --> 00:18:36,510
another star and lensing it a little bit

424
00:18:40,730 --> 00:18:38,190
so there's all these little thing it's a

425
00:18:42,140 --> 00:18:40,740
very dynamic place and this is an

426
00:18:45,200 --> 00:18:42,150
example of the kind of things that

427
00:18:46,730 --> 00:18:45,210
Hubble has discovered that we didn't

428
00:18:48,980 --> 00:18:46,740
expect it's like it's the kind of thing

429
00:18:50,419 --> 00:18:48,990
you get from launching missions like

430
00:18:51,710 --> 00:18:50,429
this you find out all kinds of things

431
00:18:54,289 --> 00:18:51,720
you didn't even know or didn't even

432
00:19:00,789 --> 00:18:54,299
anticipate so um we're not gonna have

433
00:19:09,620 --> 00:19:02,299
yeah

434
00:19:11,539 --> 00:19:09,630
NGC 4621 what is that 1991 okay well I

435
00:19:15,409 --> 00:19:11,549
don't know what it is I can't I can't

436
00:19:17,210 --> 00:19:15,419
tell what it's at and the other thing is

437
00:19:19,760 --> 00:19:17,220
we may want to skip ahead a little bit

438
00:19:22,039 --> 00:19:19,770

because this is this that the thing is

439
00:19:28,820 --> 00:19:22,049
that these images are from the early

440
00:19:31,010 --> 00:19:28,830
days before the telescope was full of an

441
00:19:32,990 --> 00:19:31,020
image before the the spherical

442
00:19:35,450 --> 00:19:33,000
aberration was corrected okay so I know

443
00:19:37,600 --> 00:19:35,460
this is this one's just to give some

444
00:19:40,340 --> 00:19:37,610
context about what this image is it's

445
00:19:41,900 --> 00:19:40,350
where we're discovering disc feeling a

446
00:19:45,500 --> 00:19:41,910
possible black hole so there's a very

447
00:19:46,700 --> 00:19:45,510
early dignities of Hubble and and yeah

448
00:19:48,710 --> 00:19:46,710
so some things are looking a little

449
00:19:51,290 --> 00:19:48,720
fuzzy and we'll see actually in a couple

450
00:19:52,260 --> 00:19:51,300
images the the big difference will

451
00:19:54,390 --> 00:19:52,270
happen when we were able

452
00:19:56,160 --> 00:19:54,400
yeah let's go to that let's go let's go

453
00:19:57,390 --> 00:19:56,170
to the next one and then we'll go to the

454
00:19:59,669 --> 00:19:57,400
one you're talking that's just a real

455
00:20:02,610 --> 00:19:59,679
pretty picture there yeah this is a

456
00:20:06,630 --> 00:20:02,620
rocket I've got a better one lined up

457
00:20:09,180 --> 00:20:06,640
later on in the show right after this we

458
00:20:11,940 --> 00:20:09,190
should we should look at the Orion

459
00:20:14,850 --> 00:20:11,950
because the Orion so this was one of the

460
00:20:18,570 --> 00:20:14,860
first images of the Orion Nebula prior

461
00:20:21,780 --> 00:20:18,580
to the repair right yes which is that

462
00:20:26,220 --> 00:20:21,790
which year is that 92 92

463
00:20:28,260 --> 00:20:26,230

yeah anything before in 95 yeah so so

464
00:20:31,190 --> 00:20:28,270
this is early but actually I think it

465
00:20:34,260 --> 00:20:31,200
would be a good idea to show if you have

466
00:20:36,630 --> 00:20:34,270
one of the mosaics of the Orion that

467
00:20:42,570 --> 00:20:36,640
would be that would be amazing to have

468
00:20:48,810 --> 00:20:42,580
yes it's got everything you mean this is

469
00:20:51,480 --> 00:20:48,820
yet so in 2006 I mean there we go is

470
00:20:56,580 --> 00:20:51,490
that showing on the Hangout yeah so this

471
00:20:59,810 --> 00:20:56,590
is a large image of Orion and a chose a

472
00:21:02,340 --> 00:20:59,820
very large region and this is actually

473
00:21:03,660 --> 00:21:02,350
this nebula although you you're not

474
00:21:05,310 --> 00:21:03,670
going to just look up and see it and

475
00:21:08,130 --> 00:21:05,320
move to see it like this it is a fuzzy

476
00:21:12,210 --> 00:21:08,140
spot if you have if you're a really dark

477
00:21:14,460 --> 00:21:12,220
place it's part of the nebula region in

478
00:21:17,280 --> 00:21:14,470
Orion near the belt and the sword and

479
00:21:21,419 --> 00:21:17,290
that whole region has all kinds of star

480
00:21:23,820 --> 00:21:21,429
formation and really interesting things

481
00:21:26,310 --> 00:21:23,830
but Orion the Orion Nebula is very

482
00:21:31,820 --> 00:21:26,320
famous because it has a lot of structure

483
00:21:36,060 --> 00:21:31,830
in it and there's also a feeling of it

484
00:21:37,530 --> 00:21:36,070
that that was produced yes okay so Scott

485
00:21:40,860 --> 00:21:37,540
while you do the before and after thing

486
00:21:44,880 --> 00:21:40,870
I want to get to a quick question on

487
00:21:47,280 --> 00:21:44,890
YouTube this was from Sergio Monta la

488
00:21:51,000 --> 00:21:47,290

montee far sorry if I'm messing up your

489
00:21:53,250 --> 00:21:51,010
names guys is the Hubble data only

490
00:21:55,350 --> 00:21:53,260
available in the legacy archive or is it

491
00:21:58,290 --> 00:21:55,360
available in other another sites where

492
00:22:00,150 --> 00:21:58,300
can i download planetary data thank you

493
00:22:02,400 --> 00:22:00,160
no it's not only available in the legacy

494
00:22:04,580 --> 00:22:02,410
archive but there's also the Mikulski

495
00:22:06,270 --> 00:22:04,590
archive for Space Telescope's

496
00:22:08,250 --> 00:22:06,280
called mass

497
00:22:10,380 --> 00:22:08,260
which you can do science queries against

498
00:22:17,520 --> 00:22:10,390
and get planetary data that way is there

499
00:22:20,100 --> 00:22:17,530
anything else Carol well okay the Hubble

500
00:22:22,110 --> 00:22:20,110
legacy archive is an interface into the

501
00:22:25,410 --> 00:22:22,120
archive you can also go to what's called

502
00:22:31,500 --> 00:22:25,420
the portal so if you go to archive STScI

503
00:22:34,470 --> 00:22:31,510
dot edu that's a different interface the

504
00:22:39,840 --> 00:22:34,480
planetary data should be available

505
00:22:41,490 --> 00:22:39,850
through the main archive page I believe

506
00:22:44,280 --> 00:22:41,500
but I haven't actually tried to search

507
00:22:46,830 --> 00:22:44,290
my yeah okay so on that right there's a

508
00:22:48,780 --> 00:22:46,840
main archive page which is where the

509
00:22:52,860 --> 00:22:48,790
science data is and that Hubble legacy

510
00:22:56,100 --> 00:22:52,870
archive includes that data but also then

511
00:22:59,600 --> 00:22:56,110
a lot of process data as well so archive

512
00:23:02,160 --> 00:22:59,610
data stsci edu and you can also check

513
00:23:04,590 --> 00:23:02,170

later where there's new there's gonna be

514
00:23:05,940 --> 00:23:04,600
a revamped interface for that as well

515
00:23:07,380 --> 00:23:05,950
which we're gonna have a hangout on a

516
00:23:08,550 --> 00:23:07,390
little bit later once week once it gets

517
00:23:11,610 --> 00:23:08,560
released so thank you for the question

518
00:23:13,860 --> 00:23:11,620
Sergio okay so as we move along I'd

519
00:23:17,610 --> 00:23:13,870
actually I'd like to actually pick some

520
00:23:21,540 --> 00:23:17,620
images yes go right ahead that and so

521
00:23:28,590 --> 00:23:21,550
I'm great aren't you Carol yeah she's

522
00:23:30,720 --> 00:23:28,600
gone rogue sure this is just a

523
00:23:32,580 --> 00:23:30,730
particular list that list that's

524
00:23:33,180 --> 00:23:32,590
actually on the website is different

525
00:23:35,880 --> 00:23:33,190
than this

526
00:23:38,640 --> 00:23:35,890
and so I I want to make sure that we

527
00:23:40,920 --> 00:23:38,650
cover some of the images that we that we

528
00:23:44,640 --> 00:23:40,930
put on this website that have prepared

529
00:23:46,470 --> 00:23:44,650
posters okay um but anyway go ahead so

530
00:23:49,050 --> 00:23:46,480
what I wanted to show here this is

531
00:23:52,380 --> 00:23:49,060
actually from 1994 and what's on the

532
00:23:53,820 --> 00:23:52,390
Flickr stream is I thought wasn't really

533
00:23:55,890 --> 00:23:53,830
indicative of what we're trying to show

534
00:23:58,350 --> 00:23:55,900
but I pulled this up from our press

535
00:24:03,540 --> 00:23:58,360
archive and this is when we're seeing

536
00:24:04,920 --> 00:24:03,550
things change so this is of m100 the

537
00:24:06,600 --> 00:24:04,930
block technically is there and so you

538
00:24:09,960 --> 00:24:06,610

can see here on the Left what we were

539
00:24:11,190 --> 00:24:09,970
seeing beforehand and then when we were

540
00:24:15,450 --> 00:24:11,200
able to put up the white pillow

541
00:24:18,000 --> 00:24:15,460
planetary camera 2 we see a huge upgrade

542
00:24:20,040 --> 00:24:18,010
and what we were able to see and this

543
00:24:24,540 --> 00:24:20,050
this here I think

544
00:24:26,850 --> 00:24:24,550
really shows on that we over 25 years

545
00:24:31,410 --> 00:24:26,860
and this is early on that we've been

546
00:24:33,570 --> 00:24:31,420
able to go up to Hubble and and upgrade

547
00:24:35,610 --> 00:24:33,580
it and be able to expand what it was

548
00:24:37,290 --> 00:24:35,620
originally meant to do as you know we'll

549
00:24:39,230 --> 00:24:37,300
see later on was frontier fields and

550
00:24:43,050 --> 00:24:39,240
things like that but we've been able to

551
00:24:45,390 --> 00:24:43,060
continually improve ourselves and using

552
00:24:49,080 --> 00:24:45,400
this fantastic tool we have in the earth

553
00:24:51,900 --> 00:24:49,090
orbit to to get better resolution and to

554
00:24:53,400 --> 00:24:51,910
look further back in time and space with

555
00:24:55,380 --> 00:24:53,410
with Hubble and so I think this is a

556
00:24:57,480 --> 00:24:55,390
really great image that shows that

557
00:24:59,460 --> 00:24:57,490
though we might have had some speed

558
00:25:01,740 --> 00:24:59,470
bumps in the beginning we've been able

559
00:25:03,750 --> 00:25:01,750
to go up fix those and and prove them

560
00:25:09,060 --> 00:25:03,760
beyond what we were intending to do in

561
00:25:10,860 --> 00:25:09,070
the first place right so uh yeah I mean

562
00:25:13,560 --> 00:25:10,870
that's okay so that's kind of the

563
00:25:20,730 --> 00:25:13,570

turning point at which now the telescope

564
00:25:23,550 --> 00:25:20,740
has been really improved so one of the

565
00:25:25,500 --> 00:25:23,560
ones another one that I wanted to before

566
00:25:27,780 --> 00:25:25,510
I don't want to go out into the universe

567
00:25:33,720 --> 00:25:27,790
the universe yet yeah so we've looked at

568
00:25:36,810 --> 00:25:33,730
the Orion Nebula there's one that I

569
00:25:39,810 --> 00:25:36,820
think is very interesting which is the

570
00:25:42,470 --> 00:25:39,820
Horsehead Nebula I'm actually putting

571
00:25:46,620 --> 00:25:42,480
that up on my screen so I guess I can

572
00:25:48,300 --> 00:25:46,630
try this okay well while you're

573
00:25:51,600 --> 00:25:48,310
screen-sharing I'm gonna read a quick

574
00:25:54,900 --> 00:25:51,610
question from Pauline Ocalan from the

575
00:25:56,880 --> 00:25:54,910
Q&A app she's asking I've always been

576
00:25:58,650 --> 00:25:56,890
curious as to how one is able to rent

577
00:26:00,330 --> 00:25:58,660
time using Hubble what are the

578
00:26:02,670 --> 00:26:00,340
qualifications does a certain type of

579
00:26:04,890 --> 00:26:02,680
research take precedence over another or

580
00:26:06,840 --> 00:26:04,900
is it more independent on who is doing

581
00:26:08,580 --> 00:26:06,850
the research I imagine there's quite a

582
00:26:11,340 --> 00:26:08,590
waitlist so the answer to that question

583
00:26:13,860 --> 00:26:11,350
is we the short answer is we've done a

584
00:26:15,690 --> 00:26:13,870
hangout on this very topic it's so do a

585
00:26:17,190 --> 00:26:15,700
search on our playlist for Hubble

586
00:26:18,720 --> 00:26:17,200
hangouts and it's called how to use

587
00:26:20,520 --> 00:26:18,730
Hubble okay and we've talked about this

588
00:26:23,130 --> 00:26:20,530

exact thing in great detail but the

589
00:26:25,140 --> 00:26:23,140
slightly longer but not as long as the

590
00:26:26,850 --> 00:26:25,150
Hangout answer is we have a committee a

591
00:26:30,710 --> 00:26:26,860
time allocation committee where

592
00:26:33,420 --> 00:26:30,720
proposals are sent and they are they are

593
00:26:37,890 --> 00:26:33,430
a look

594
00:26:41,070 --> 00:26:37,900
that over the course of or did we lose

595
00:26:43,140 --> 00:26:41,080
Carol and they are looked at over based

596
00:26:46,740 --> 00:26:43,150
on a lot of criteria mostly their

597
00:26:52,590 --> 00:26:46,750
science impact yeah you lost me for

598
00:26:53,580 --> 00:26:52,600
second to my at crash oh it did well I'm

599
00:26:55,920 --> 00:26:53,590
glad I'm still here

600
00:27:00,150 --> 00:26:55,930
so anyway that's a good question and

601
00:27:02,910 --> 00:27:00,160
it's a very it is a very scientifically

602
00:27:04,590 --> 00:27:02,920
fair process I think I think it but it

603
00:27:06,090 --> 00:27:04,600
you're right it is very competitive they

604
00:27:07,950 --> 00:27:06,100
get way more proposals than they ever

605
00:27:11,820 --> 00:27:07,960
have time for okay do you have another

606
00:27:13,680 --> 00:27:11,830
what happened I'm having an

607
00:27:16,290 --> 00:27:13,690
infrastructure problem i thought that i

608
00:27:18,450 --> 00:27:16,300
clicked on screen share but it's not

609
00:27:20,790 --> 00:27:18,460
okay do you want to port enter right you

610
00:27:26,610 --> 00:27:20,800
just talk about horse head nebula that

611
00:27:28,500 --> 00:27:26,620
new one yeah yeah okay 2013 okay yes

612
00:27:33,300 --> 00:27:28,510
this is one of my favorite images go

613
00:27:35,730 --> 00:27:33,310

ahead Carol so this image this was

614
00:27:38,820 --> 00:27:35,740
interesting because we had done several

615
00:27:45,300 --> 00:27:38,830
images of the horse head in the past

616
00:27:47,340 --> 00:27:45,310
and that so it's a the Hubble is a

617
00:27:49,080 --> 00:27:47,350
really tiny part of the horse head just

618
00:27:51,810 --> 00:27:49,090
too right at the top and then there's a

619
00:27:53,940 --> 00:27:51,820
beautiful ground-based telescope many

620
00:27:55,320 --> 00:27:53,950
amateurs have taken beautiful images too

621
00:27:59,580 --> 00:27:55,330
so it was kind of fun because a lot of

622
00:28:00,990 --> 00:27:59,590
people contributed their their images of

623
00:28:04,530 --> 00:28:01,000
the horse head as well so it's a very

624
00:28:07,230 --> 00:28:04,540
famous amateur object and it's also part

625
00:28:10,290 --> 00:28:07,240
in a very large extension of where the

626
00:28:13,140 --> 00:28:10,300
Orion Nebula is as well so anyway we

627
00:28:15,540 --> 00:28:13,150
decided that we had done the horse head

628
00:28:17,520 --> 00:28:15,550
in the visible before and then we

629
00:28:20,760 --> 00:28:17,530
decided to try to do it in the infrared

630
00:28:23,760 --> 00:28:20,770
and the team actually had a long no

631
00:28:26,040 --> 00:28:23,770
spanning many meetings like over several

632
00:28:27,920 --> 00:28:26,050
weeks of whether we were going to do the

633
00:28:30,300 --> 00:28:27,930
infrared or we were going to do the

634
00:28:32,190 --> 00:28:30,310
ultraviolet or what what we were going

635
00:28:35,730 --> 00:28:32,200
to do it in the end we decided to do the

636
00:28:37,950 --> 00:28:35,740
infrared image and it's so stunning that

637
00:28:41,880 --> 00:28:37,960
if you bring it up on your screen the

638
00:28:43,710 --> 00:28:41,890

full image it looks 3d I mean when you

639
00:28:45,030 --> 00:28:43,720
look at it it's just amazing because you

640
00:28:46,470 --> 00:28:45,040
can see they're so you'd see right

641
00:28:46,770 --> 00:28:46,480
through it you can see stars you can see

642
00:28:49,110 --> 00:28:46,780
this

643
00:28:52,170 --> 00:28:49,120
structure and then our animators made a

644
00:28:54,780 --> 00:28:52,180
3d that's reading I know from my torts

645
00:28:56,520 --> 00:28:54,790
and it's a really nice image it's just a

646
00:28:58,620 --> 00:28:56,530
stunning image that's one that you want

647
00:29:01,710 --> 00:28:58,630
to print and put on your wall so that's

648
00:29:05,010 --> 00:29:01,720
yes very dancin very cool

649
00:29:06,060 --> 00:29:05,020
so that's star formation right so you

650
00:29:08,730 --> 00:29:06,070
got another one for us

651
00:29:14,100 --> 00:29:08,740
so there's another one which is I think

652
00:29:21,770 --> 00:29:14,110
is on on your list which is 5189 which

653
00:29:24,090 --> 00:29:21,780
was a 2012 image and so so the horse had

654
00:29:26,190 --> 00:29:24,100
is the star formation

655
00:29:29,430 --> 00:29:26,200
Orion is store information this is what

656
00:29:32,430 --> 00:29:29,440
happens when a star like our Sun gives

657
00:29:34,800 --> 00:29:32,440
off its atmosphere now in this case the

658
00:29:40,230 --> 00:29:34,810
star like our Sun does not completely

659
00:29:42,570 --> 00:29:40,240
explode it gives off part of its

660
00:29:44,910 --> 00:29:42,580
atmosphere and the interesting thing is

661
00:29:47,220 --> 00:29:44,920
that early on it was thought that a star

662
00:29:50,250 --> 00:29:47,230
would do this once but it turns out it

663
00:29:53,640 --> 00:29:50,260

it does it more than once and originally

664
00:29:56,610 --> 00:29:53,650
they thought we thought that it would it

665
00:30:01,700 --> 00:29:56,620
would just be kind of evil either sort

666
00:30:07,110 --> 00:30:04,800
this is a pretty interesting image

667
00:30:11,220 --> 00:30:07,120
because it's it's completely unexpected

668
00:30:12,990 --> 00:30:11,230
to it it kind of looked looks like you

669
00:30:14,910 --> 00:30:13,000
know when you go out in your garden and

670
00:30:18,180 --> 00:30:14,920
you turn on your garden hose and you

671
00:30:20,250 --> 00:30:18,190
forgot to you know clamp it down and it

672
00:30:22,650 --> 00:30:20,260
just goes all over the place so it sort

673
00:30:25,370 --> 00:30:22,660
of looks like from the center that

674
00:30:28,110 --> 00:30:25,380
there's some kind of Jets and and

675
00:30:31,290 --> 00:30:28,120
something that has like spewed off

676
00:30:34,230 --> 00:30:31,300
material in rings and in loops and in

677
00:30:37,530 --> 00:30:34,240
spirals and then as that is all

678
00:30:39,450 --> 00:30:37,540
illuminated it ionizes different at

679
00:30:41,670 --> 00:30:39,460
chemical elements and that that's what

680
00:30:44,010 --> 00:30:41,680
gives it the color but it's it's such a

681
00:30:46,500 --> 00:30:44,020
complicated structure you can imagine I

682
00:30:48,840 --> 00:30:46,510
mean this is very hard tomorrow yeah I

683
00:30:51,210 --> 00:30:48,850
miss you as you look at it more and more

684
00:30:53,160 --> 00:30:51,220
detail you see you know it's not just

685
00:30:54,710 --> 00:30:53,170
it's not smooth at all it's got all

686
00:30:58,130 --> 00:30:54,720
these nodules

687
00:31:01,520 --> 00:30:58,140
it streams outward and it's just as

688
00:31:03,649 --> 00:31:01,530

we're very complicated but that's what

689
00:31:05,510 --> 00:31:03,659
can happen to a store if it has it

690
00:31:08,870 --> 00:31:05,520
probably has magnetic fields it's

691
00:31:11,090 --> 00:31:08,880
probably rotating and as it loses it the

692
00:31:13,039 --> 00:31:11,100
the atmosphere this is what happens and

693
00:31:15,080 --> 00:31:13,049
then it ionized there's a white dwarf in

694
00:31:17,330 --> 00:31:15,090
there somewhere isn't there somewhere in

695
00:31:19,970 --> 00:31:17,340
there there's life so this is how stars

696
00:31:22,100 --> 00:31:19,980
like the Sun will die very beautiful and

697
00:31:26,390 --> 00:31:22,110
we won't want to be around I want to get

698
00:31:28,549 --> 00:31:26,400
a quick question from Brad M how long is

699
00:31:30,370 --> 00:31:28,559
it estimated will Hubble be able to be

700
00:31:33,110 --> 00:31:30,380
upgraded before it becomes obsolete

701
00:31:34,789 --> 00:31:33,120
Hubble has gotten its last upgrade

702
00:31:37,460 --> 00:31:34,799
don't be getting upgraded any more that

703
00:31:40,159 --> 00:31:37,470
happened back in 2009 as far as becoming

704
00:31:41,990 --> 00:31:40,169
obsolete I don't think that's possible I

705
00:31:44,480 --> 00:31:42,000
think it'll always be usable as long as

706
00:31:50,390 --> 00:31:44,490
it stays up there now if we do nothing

707
00:31:53,750 --> 00:31:50,400
to it then the then the its orbit will

708
00:31:54,830 --> 00:31:53,760
begin to go down and around 2025 things

709
00:31:56,210 --> 00:31:54,840
will start we'll have to start thinking

710
00:31:57,649 --> 00:31:56,220
about what we're gonna you know how what

711
00:31:59,149 --> 00:31:57,659
we're going to do with Hubble at that

712
00:32:00,230 --> 00:31:59,159
point but that's a long way off and

713
00:32:01,850 --> 00:32:00,240

right now Hubble is in great shape

714
00:32:03,500 --> 00:32:01,860
taking great data and like we said

715
00:32:06,860 --> 00:32:03,510
earlier we want to be able to use at the

716
00:32:08,049 --> 00:32:06,870
same times JWST so hopefully Hubble will

717
00:32:11,149 --> 00:32:08,059
still be around for a very long time

718
00:32:13,549 --> 00:32:11,159
okay so there are there are two to more

719
00:32:15,970 --> 00:32:13,559
images I really want to show well there

720
00:32:19,669 --> 00:32:15,980
are several but there there is one

721
00:32:23,330 --> 00:32:19,679
there's one that's called NGC 6302 and

722
00:32:26,180 --> 00:32:23,340
the other one is the Crab Nebula so well

723
00:32:28,310 --> 00:32:26,190
I guess what we're talking about stars

724
00:32:32,029 --> 00:32:28,320
that explode the image of the Crab

725
00:32:34,190 --> 00:32:32,039
Nebula would be fantastic yes take a

726
00:32:39,200 --> 00:32:34,200
look at that represents an explosion

727
00:32:44,029 --> 00:32:39,210
that happened in 1054 yes ah based on an

728
00:32:49,399 --> 00:32:44,039
explosion was actually visible by people

729
00:32:51,919 --> 00:32:49,409
who knew the sky very well and so you

730
00:32:54,260 --> 00:32:51,929
know it exploded and then nobody knew

731
00:32:57,110 --> 00:32:54,270
what it was until there were telescopes

732
00:32:59,029 --> 00:32:57,120
and then the first telescopes began to

733
00:33:02,139 --> 00:32:59,039
understand that there was a nebula there

734
00:33:07,250 --> 00:33:02,149
and then the observation with Hubble

735
00:33:08,180 --> 00:33:07,260
really demonstrated in detail so Scott

736
00:33:15,740 --> 00:33:08,190
are you there

737
00:33:19,280 --> 00:33:15,750
yeah I'm here okay okay finding it yeah

738
00:33:22,310 --> 00:33:19,290

so this this image is quite amazing and

739
00:33:24,170 --> 00:33:22,320
we're talking about yeah and in the last

740
00:33:26,690 --> 00:33:24,180
case of the planetary nebula and

741
00:33:28,910 --> 00:33:26,700
contrast that one's pretty complicated

742
00:33:31,240 --> 00:33:28,920
but this one's really complicated and

743
00:33:36,710 --> 00:33:31,250
the reason that it has this really

744
00:33:39,080 --> 00:33:36,720
tortured structure I don't know it kind

745
00:33:42,380 --> 00:33:39,090
of looks like taffy that exploded or

746
00:33:45,650 --> 00:33:42,390
something I don't know what it is

747
00:33:49,430 --> 00:33:45,660
magnetic fields that causes ionized

748
00:33:51,830 --> 00:33:49,440
material to make that web-like structure

749
00:33:54,890 --> 00:33:51,840
and so you know some of it's compressed

750
00:33:57,800 --> 00:33:54,900
some of it's spread out and so in the

751
00:33:59,990 --> 00:33:57,810
explosion these magnetic fields come out

752
00:34:04,310 --> 00:34:00,000
and they get all twisted up and they

753
00:34:07,520 --> 00:34:04,320
track the material and then the as the

754
00:34:10,490 --> 00:34:07,530
explosion then produces a lot of light

755
00:34:14,300 --> 00:34:10,500
and that causes the material to blow

756
00:34:15,800 --> 00:34:14,310
again because it's ionized material and

757
00:34:18,020 --> 00:34:15,810
the different colors are the different

758
00:34:20,150 --> 00:34:18,030
the different elements but this is the

759
00:34:22,850 --> 00:34:20,160
kind of thing like supernova explosion

760
00:34:25,669 --> 00:34:22,860
of interesting and studied because this

761
00:34:27,860 --> 00:34:25,679
is where the heavy elements carbon

762
00:34:30,350 --> 00:34:27,870
nitrogen oxygen but all the other

763
00:34:35,540 --> 00:34:30,360

elements like silicon plutonium other

764
00:34:36,980 --> 00:34:35,550
star stuff and so they make that in

765
00:34:39,290 --> 00:34:36,990
their interiors and then when these

766
00:34:42,320 --> 00:34:39,300
stars blow up they spew that stuff back

767
00:34:46,880 --> 00:34:42,330
out into space and as this nebula

768
00:34:49,640 --> 00:34:46,890
expands into material nearby that stuff

769
00:34:52,550 --> 00:34:49,650
is compressed and then you start getting

770
00:34:54,710 --> 00:34:52,560
new stars this is the crucible of all

771
00:34:58,850 --> 00:34:54,720
that make us up it's where it comes from

772
00:35:00,680 --> 00:34:58,860
is right there okay so go ahead well I

773
00:35:02,420 --> 00:35:00,690
was just gonna say the next one we ought

774
00:35:07,340 --> 00:35:02,430
to look at since we were talking about

775
00:35:08,720 --> 00:35:07,350
that is a NGC 3603 okay well Scott pulls

776
00:35:11,030 --> 00:35:08,730
that up I'm gonna get to a quick

777
00:35:13,220 --> 00:35:11,040
question that I've I wouldn't I like the

778
00:35:14,930 --> 00:35:13,230
answer to this too and I will there be a

779
00:35:17,330 --> 00:35:14,940
chance this is from see sorry from the

780
00:35:20,390 --> 00:35:17,340
Q&A will there be a chance that Hubble

781
00:35:21,650 --> 00:35:20,400
makes pictures of the remains of eagle

782
00:35:23,930 --> 00:35:21,660
the eagle lander the

783
00:35:27,520 --> 00:35:23,940
moon rover etc on the surface of the

784
00:35:30,049 --> 00:35:27,530
Moon Carol do we ever have any plans to

785
00:35:30,789 --> 00:35:30,059
look at the moon with Hubble to see

786
00:35:34,339 --> 00:35:30,799
those things

787
00:35:37,160 --> 00:35:34,349
no the nudist should write to do that

788
00:35:39,260 --> 00:35:37,170

but there has been observation and

789
00:35:42,440 --> 00:35:39,270
remember Hubble is a science instrument

790
00:35:44,210 --> 00:35:42,450
there have been flybys and other

791
00:35:49,450 --> 00:35:44,220
telescopes that have already imaged

792
00:35:53,960 --> 00:35:49,460
those things the you know there there's

793
00:35:55,579 --> 00:35:53,970
Lunar Reconnaissance Orbiter and things

794
00:35:57,230 --> 00:35:55,589
like that I mean those LRO

795
00:35:59,569 --> 00:35:57,240
takes pictures of the surface all over

796
00:36:02,650 --> 00:35:59,579
the place yeah other satellites there

797
00:36:05,990 --> 00:36:02,660
that are taking much better resolution

798
00:36:08,839 --> 00:36:06,000
there were some observations of the moon

799
00:36:11,480 --> 00:36:08,849
near the Terminator to sit look for the

800
00:36:14,059 --> 00:36:11,490
possibility of evidence of water which

801
00:36:19,700 --> 00:36:14,069
was not found but that's one observation

802
00:36:24,140 --> 00:36:19,710
and then Mars we've mostly done we've

803
00:36:27,470 --> 00:36:24,150
done looking for at the weather but we

804
00:36:30,319 --> 00:36:27,480
can't actually resolve the the actual

805
00:36:35,299 --> 00:36:30,329
Landers but the there are orbiters

806
00:36:37,400 --> 00:36:35,309
around Mars like we have Landsat and GUI

807
00:36:39,440 --> 00:36:37,410
and stuff like that that go around our

808
00:36:41,809 --> 00:36:39,450
own planet we have we have satellites

809
00:36:44,329 --> 00:36:41,819
that go around Mars that have great

810
00:36:48,589 --> 00:36:44,339
resolution that stuff then they have

811
00:36:52,730 --> 00:36:48,599
found oh hello

812
00:36:55,579 --> 00:36:52,740
yeah I'm here Anders and bounce around

813
00:36:57,440 --> 00:36:55,589

in their pillows and those have been

814
00:36:59,660 --> 00:36:57,450
found and all that so those images are

815
00:37:02,839 --> 00:36:59,670
quite spectacular but no we're mainly as

816
00:37:06,079 --> 00:37:02,849
we do some science and science studies

817
00:37:07,700 --> 00:37:06,089
oh we don't do that's a good one Caesar

818
00:37:09,049 --> 00:37:07,710
thank you for for asking that

819
00:37:11,200 --> 00:37:09,059
I'm Scott how are we doing on the are

820
00:37:20,079 --> 00:37:11,210
you able to find what she was asking for

821
00:37:22,609 --> 00:37:20,089
36 let me pull it up here yeah now that

822
00:37:25,940 --> 00:37:22,619
so what we were talking about before

823
00:37:27,980 --> 00:37:25,950
when we talked about at the Crab Nebula

824
00:37:32,299 --> 00:37:27,990
so we've seen star formation regions and

825
00:37:35,030 --> 00:37:32,309
we saw nebulae like the Sun blow up and

826
00:37:38,360 --> 00:37:35,040
we also seen

827
00:37:40,370 --> 00:37:38,370
they are tough more puffballs but quite

828
00:37:42,860 --> 00:37:40,380
dynamic and then Crab Nebula so we have

829
00:37:45,170 --> 00:37:42,870
supernovae that blow up and you and in

830
00:37:47,090 --> 00:37:45,180
this in this case this is the material

831
00:37:49,370 --> 00:37:47,100
so there was a material that came from

832
00:37:51,050 --> 00:37:49,380
those early stars that blew up and all

833
00:37:52,790 --> 00:37:51,060
that stuff mixed together and it

834
00:37:56,270 --> 00:37:52,800
collapsed and it made this star cluster

835
00:37:59,660 --> 00:37:56,280
and so this star cluster it's a bunch of

836
00:38:01,580 --> 00:37:59,670
stars that have formed together I just

837
00:38:02,990 --> 00:38:01,590
think it's quite beautiful there's

838
00:38:06,530 --> 00:38:03,000

hundreds of stars that have formed

839
00:38:09,560 --> 00:38:06,540
together and it is emerging from the

840
00:38:12,200 --> 00:38:09,570
material out of which it was born so in

841
00:38:15,530 --> 00:38:12,210
Orion we can't see these star clusters

842
00:38:17,300 --> 00:38:15,540
yet because they're still embedded but

843
00:38:21,440 --> 00:38:17,310
here's a case where there's a nebula

844
00:38:23,240 --> 00:38:21,450
where it is old enough that the ionizing

845
00:38:26,060 --> 00:38:23,250
radiation from the stars in the cluster

846
00:38:28,790 --> 00:38:26,070
has pushed that material away and you

847
00:38:31,340 --> 00:38:28,800
can you can see that it's it's sculpted

848
00:38:34,640 --> 00:38:31,350
things away and it's pushing it out and

849
00:38:36,170 --> 00:38:34,650
pushing material in into you know some

850
00:38:37,040 --> 00:38:36,180
material into the material that was

851
00:38:40,640 --> 00:38:37,050
already there

852
00:38:42,470 --> 00:38:40,650
so I think the emerging clusters are

853
00:38:44,270 --> 00:38:42,480
really of interest to me and I really

854
00:38:46,040 --> 00:38:44,280
like this costume they're also among the

855
00:38:49,610 --> 00:38:46,050
beautiful images to that Hubble has ever

856
00:38:52,030 --> 00:38:49,620
taken I think this is amazing yeah to

857
00:38:55,670 --> 00:38:52,040
illustrate a similar point another

858
00:38:58,370 --> 00:38:55,680
another cluster that we looked at was

859
00:39:02,630 --> 00:38:58,380
the tarantula nebula okay

860
00:39:08,030 --> 00:39:02,640
the tarantula in it go ahead

861
00:39:09,140 --> 00:39:08,040
did you okay all right let's go go ahead

862
00:39:13,820 --> 00:39:09,150
well that's wait till he gets it up

863
00:39:15,050 --> 00:39:13,830

before you talk about it it's a good

864
00:39:17,030 --> 00:39:15,060
opportunity for you to get to we've got

865
00:39:18,890 --> 00:39:17,040
a lot of questions you guys are really

866
00:39:21,920 --> 00:39:18,900
doing great thank you so much for

867
00:39:23,450 --> 00:39:21,930
sending on another question yes so Tony

868
00:39:25,280 --> 00:39:23,460
Lynch is asking this might sound like a

869
00:39:27,890 --> 00:39:25,290
wacky idea would it have been possible

870
00:39:31,250 --> 00:39:27,900
or even feasible to lower the HST x'

871
00:39:34,130 --> 00:39:31,260
orbit and attach it to the ISS it's a

872
00:39:35,570 --> 00:39:34,140
good idea and when John Grunsfeld left

873
00:39:38,630 --> 00:39:35,580
on the last servicing mission when he

874
00:39:41,630 --> 00:39:38,640
left Hubble in orbit he attached a black

875
00:39:43,070 --> 00:39:41,640
ring around bottom of the telescope but

876
00:39:44,720 --> 00:39:43,080
if you look at some of those pictures of

877
00:39:47,720 --> 00:39:44,730
the Hubble in space you can see it there

878
00:39:48,710 --> 00:39:47,730
so in theory it's possible to send up

879
00:39:51,980 --> 00:39:48,720
maybe a space

880
00:39:56,120 --> 00:39:51,990
robotic satellite or something they can

881
00:39:58,670 --> 00:39:56,130
grab it and pull it down we do not want

882
00:40:00,800 --> 00:39:58,680
to do that because the ISS is a really

883
00:40:02,900 --> 00:40:00,810
crappy and smells getting you dude why

884
00:40:03,380 --> 00:40:02,910
would we want to we don't want to do

885
00:40:05,420 --> 00:40:03,390
that

886
00:40:06,800 --> 00:40:05,430
and you know I understand yeah you'd

887
00:40:08,180 --> 00:40:06,810
have it right next door and you could

888
00:40:09,920 --> 00:40:08,190

change the instrumentation but then you

889
00:40:12,200 --> 00:40:09,930
but then you really compromise the

890
00:40:14,900 --> 00:40:12,210
integrity of first of all the the

891
00:40:17,210 --> 00:40:14,910
cleanliness of the instrumentation so

892
00:40:19,610 --> 00:40:17,220
there's contamination from the ISS and

893
00:40:22,430 --> 00:40:19,620
secondly you can get stuff on the mirror

894
00:40:26,300 --> 00:40:22,440
and so it's much better to have Hubble

895
00:40:28,340 --> 00:40:26,310
isolated away from a the atmosphere so

896
00:40:29,840 --> 00:40:28,350
that's why it's so high because there is

897
00:40:32,300 --> 00:40:29,850
still a little bit of atmosphere up

898
00:40:33,740 --> 00:40:32,310
there and we don't want it in a dirty

899
00:40:35,360 --> 00:40:33,750
environment and there have been many

900
00:40:38,480 --> 00:40:35,370
cases there have been several proposals

901
00:40:41,390 --> 00:40:38,490
of putting demonstrator telescopes

902
00:40:43,300 --> 00:40:41,400
tethered to the ISS but it is well

903
00:40:46,040 --> 00:40:43,310
understood by the astronomical community

904
00:40:48,050 --> 00:40:46,050
that if you put a facility up there it

905
00:40:50,420 --> 00:40:48,060
will be very dirty right that it will

906
00:40:52,340 --> 00:40:50,430
not have beautiful image quality and you

907
00:40:54,530 --> 00:40:52,350
will compromise your instruments over

908
00:40:55,730 --> 00:40:54,540
some period of time but I think the

909
00:40:57,470 --> 00:40:55,740
spirit of the question was could we

910
00:40:59,600 --> 00:40:57,480
maybe do that bring it down to ISS

911
00:41:03,860 --> 00:40:59,610
repair it and then move it back up again

912
00:41:07,130 --> 00:41:03,870
but that would be no that's a lot of

913
00:41:12,350 --> 00:41:07,140

work and and it can't be moved because

914
00:41:14,420 --> 00:41:12,360
solar the solar you know this the solar

915
00:41:17,090 --> 00:41:14,430
panels are deployed and there's no way

916
00:41:19,010 --> 00:41:17,100
to fold them up okay and you can't fold

917
00:41:20,270 --> 00:41:19,020
the antenna and all that it went up in

918
00:41:23,690 --> 00:41:20,280
the shuttle that was the perfect

919
00:41:25,670 --> 00:41:23,700
transport mechanism but once deployed it

920
00:41:27,770 --> 00:41:25,680
was meant to be deployed you can't fold

921
00:41:29,960 --> 00:41:27,780
it all up and you know damage it and get

922
00:41:32,840 --> 00:41:29,970
it dirty and all that stuff so yeah

923
00:41:34,160 --> 00:41:32,850
interesting ideas yeah interesting idea

924
00:41:38,090 --> 00:41:34,170
though okay Scott do you have it up here

925
00:41:41,090 --> 00:41:38,100
I do okay so the girl the tarantula is

926
00:41:42,920 --> 00:41:41,100
is interesting because so thinking about

927
00:41:45,620 --> 00:41:42,930
30 3603

928
00:41:48,980 --> 00:41:45,630
which was we saw one cluster this is a

929
00:41:51,170 --> 00:41:48,990
case where it looks like there's an

930
00:41:55,460 --> 00:41:51,180
emerging star cluster kind of on the

931
00:41:59,150 --> 00:41:55,470
left side but it does appear that in the

932
00:42:02,030 --> 00:41:59,160
detailed studies that that star cluster

933
00:42:05,359 --> 00:42:02,040
then spawn notice that there's one

934
00:42:07,609 --> 00:42:05,369
on the left but up near the top that

935
00:42:10,070 --> 00:42:07,619
these clusters are forming all over this

936
00:42:14,359 --> 00:42:10,080
region but the presence of one cluster

937
00:42:16,359 --> 00:42:14,369
this is illuminating and pushing the

938
00:42:19,460 --> 00:42:16,369

material out of which it was born

939
00:42:21,680 --> 00:42:19,470
causing it to run into other material

940
00:42:24,830 --> 00:42:21,690
and then another cluster was formed and

941
00:42:27,590 --> 00:42:24,840
so it's believed people who are studying

942
00:42:30,800 --> 00:42:27,600
this very carefully are looking at how

943
00:42:35,030 --> 00:42:30,810
many generations of star clusters are in

944
00:42:36,349 --> 00:42:35,040
this in this region and so it's pretty

945
00:42:40,490 --> 00:42:36,359
interesting because we don't have

946
00:42:42,800 --> 00:42:40,500
another good example this is in a

947
00:42:46,580 --> 00:42:42,810
companion galaxy one of the Magellanic

948
00:42:48,770 --> 00:42:46,590
Clouds and because it's far enough away

949
00:42:51,320 --> 00:42:48,780
we can see the whole region and we can

950
00:42:54,230 --> 00:42:51,330
see these multiple generations of star

951
00:42:56,330 --> 00:42:54,240
clusters and this is not just one Hubble

952
00:43:02,320 --> 00:42:56,340
image this is a Hubble mosaic so it's

953
00:43:04,940 --> 00:43:02,330
like we're using panorama cell phone so

954
00:43:07,130 --> 00:43:04,950
the biggest example of that we have our

955
00:43:08,780 --> 00:43:07,140
is the is the Andromeda image that was

956
00:43:11,930 --> 00:43:08,790
released in January called the fad image

957
00:43:13,940 --> 00:43:11,940
and that was a 300 megapixel mosaic of

958
00:43:17,390 --> 00:43:13,950
all kinds of Hubble pointings and so

959
00:43:18,950 --> 00:43:17,400
that's another idea okay I have a

960
00:43:36,349 --> 00:43:18,960
request now I want to see you deep feel

961
00:43:39,440 --> 00:43:36,359
would you would you find the latest okay

962
00:43:41,420 --> 00:43:39,450
so here's a question from Julian Oh moon

963
00:43:43,460 --> 00:43:41,430

spell from YouTube when Hubble Space

964
00:43:45,590 --> 00:43:43,470
Telescope takes an image let's say the

965
00:43:47,599 --> 00:43:45,600
Orion Nebula does it give a color image

966
00:43:50,530 --> 00:43:47,609
or do you have to process it and assign

967
00:43:53,500 --> 00:43:50,540
colors what is it convention for this

968
00:43:55,580 --> 00:43:53,510
basically it does not take color images

969
00:43:57,290 --> 00:43:55,590
which you see when we get back from

970
00:43:59,330 --> 00:43:57,300
Hubble or a bunch of grayscale images

971
00:44:01,760 --> 00:43:59,340
all taken with different filters of

972
00:44:04,370 --> 00:44:01,770
different red light wavelengths and then

973
00:44:05,840 --> 00:44:04,380
they're assembled according to those

974
00:44:07,070 --> 00:44:05,850
wavelengths are assigned a color table

975
00:44:09,320 --> 00:44:07,080
and that's where the color comes from

976
00:44:11,390 --> 00:44:09,330
that's a very short answer to your

977
00:44:13,099 --> 00:44:11,400
question but the the I wanted to give

978
00:44:15,950 --> 00:44:13,109
you the convention is basically Hubble

979
00:44:18,529 --> 00:44:15,960
has many many filters and when it takes

980
00:44:22,010 --> 00:44:18,539
image an image in that filter all it's

981
00:44:23,599 --> 00:44:22,020
got is a file with pixels and and

982
00:44:26,329 --> 00:44:23,609
numbers in it and those numbers

983
00:44:29,720 --> 00:44:26,339
represent how much of that light how

984
00:44:31,880 --> 00:44:29,730
many photons there were and so it'll be

985
00:44:34,339 --> 00:44:31,890
different in red as it would be in blue

986
00:44:41,079 --> 00:44:34,349
or green and Hubble has gosh I don't

987
00:44:45,319 --> 00:44:43,400
but an interesting note on that though

988
00:44:47,329 --> 00:44:45,329

is Hubble is the only space telescope

989
00:44:49,099 --> 00:44:47,339
that has filters in the ultraviolet so

990
00:44:50,510 --> 00:44:49,109
if you want anything the ultraviolet

991
00:44:52,549 --> 00:44:50,520
which is important for star formation

992
00:44:55,039 --> 00:44:52,559
studies and things like that Hubble is

993
00:44:56,720 --> 00:44:55,049
the only game in town so I wanted to

994
00:45:00,829 --> 00:44:56,730
comment that while this beautiful

995
00:45:03,200 --> 00:45:00,839
picture it gives you an impression of

996
00:45:05,620 --> 00:45:03,210
the astrophysics happening here in order

997
00:45:08,839 --> 00:45:05,630
to actually understand it we need those

998
00:45:10,730 --> 00:45:08,849
those filtered images we need to look at

999
00:45:13,430 --> 00:45:10,740
the the and measure because we can't

1000
00:45:16,039 --> 00:45:13,440
measure this this doesn't tell you how

1001
00:45:19,309 --> 00:45:16,049
much is emitting in oxygen and carbon

1002
00:45:22,460 --> 00:45:19,319
and nitrogen and we also need to measure

1003
00:45:24,410 --> 00:45:22,470
the stars at different band passes at

1004
00:45:27,170 --> 00:45:24,420
different energies to understand how old

1005
00:45:29,930 --> 00:45:27,180
they are how big they are all that so we

1006
00:45:33,710 --> 00:45:29,940
need the individual filters so that we

1007
00:45:34,880 --> 00:45:33,720
can understand in detail how the stars

1008
00:45:37,099 --> 00:45:34,890
what they're made of

1009
00:45:40,279 --> 00:45:37,109
and how old they are and for the nebula

1010
00:45:42,950 --> 00:45:40,289
exactly what the the chemical

1011
00:45:45,049 --> 00:45:42,960
composition is of the nebula so where is

1012
00:45:46,910 --> 00:45:45,059
the oxygen relative to the nitrogen so

1013
00:45:48,470 --> 00:45:46,920

you need to use a nitrogen filter and

1014
00:45:50,539 --> 00:45:48,480
just look at the nitrogen using the

1015
00:45:53,410 --> 00:45:50,549
oxygen filter just to look at the oxygen

1016
00:45:55,760 --> 00:45:53,420
and then you can understand the relative

1017
00:45:57,859 --> 00:45:55,770
relationship of those different

1018
00:45:59,779 --> 00:45:57,869
components in these nebulae so that's

1019
00:46:01,519 --> 00:45:59,789
what we take there we make the pretty

1020
00:46:03,589 --> 00:46:01,529
pictures because they're pretty and

1021
00:46:05,779 --> 00:46:03,599
they're interesting and they inform the

1022
00:46:09,890 --> 00:46:05,789
science but that's not what they're not

1023
00:46:22,250 --> 00:46:09,900
the heart of what scientists measure ok

1024
00:46:28,430 --> 00:46:24,140
my favorite is still the first one the

1025
00:46:29,990 --> 00:46:28,440
one from 1995 but another question then

1026
00:46:31,700 --> 00:46:30,000
while we're waiting we

1027
00:46:33,800 --> 00:46:31,710
you ever consider attaching propulsion

1028
00:46:36,020 --> 00:46:33,810
to Hubble to send it further out into

1029
00:46:38,180 --> 00:46:36,030
the solar system to possibly get better

1030
00:46:40,760 --> 00:46:38,190
images as it moves out or gets newer

1031
00:46:43,010 --> 00:46:40,770
viewpoints or possibly to other outer

1032
00:46:47,080 --> 00:46:43,020
solar system to better see what is in

1033
00:46:50,060 --> 00:46:47,090
dark areas of what I consider it sure

1034
00:46:51,950 --> 00:46:50,070
well I ever what is it is it practical I

1035
00:46:53,870 --> 00:46:51,960
don't think so I think we're leaving

1036
00:46:56,390 --> 00:46:53,880
Hubble where it is is probably the best

1037
00:46:57,380 --> 00:46:56,400
the best way to go therefore that any

1038
00:47:00,290 --> 00:46:57,390

comments on that

1039
00:47:02,000 --> 00:47:00,300
well okay Hubble was not built for that

1040
00:47:03,560 --> 00:47:02,010
but if you're going to do that kind of

1041
00:47:05,240 --> 00:47:03,570
thing you have to think about how your

1042
00:47:06,980 --> 00:47:05,250
antennas are going to work how strong

1043
00:47:10,150 --> 00:47:06,990
the antennas are going to be whether

1044
00:47:12,620 --> 00:47:10,160
they have sufficient power to do that

1045
00:47:14,480 --> 00:47:12,630
whether you can control it you have to

1046
00:47:17,240 --> 00:47:14,490
send signals and the further out you go

1047
00:47:19,130 --> 00:47:17,250
the more time length there is when

1048
00:47:21,980 --> 00:47:19,140
you're when you're pointing the

1049
00:47:24,470 --> 00:47:21,990
telescope so there are a lot of

1050
00:47:26,930 --> 00:47:24,480
considerations and so that's why the

1051
00:47:29,840 --> 00:47:26,940
telescope's that go out into the solar

1052
00:47:31,850 --> 00:47:29,850
system are very specialized they have

1053
00:47:33,500 --> 00:47:31,860
specific equipment to do the job they're

1054
00:47:36,170 --> 00:47:33,510
supposed to do and they have

1055
00:47:38,570 --> 00:47:36,180
transmitters and antennas to receive

1056
00:47:41,630 --> 00:47:38,580
commands and transmitters to transmit

1057
00:47:43,760 --> 00:47:41,640
back information that are specific to

1058
00:47:46,850 --> 00:47:43,770
that and Hubble was never built for that

1059
00:47:49,070 --> 00:47:46,860
so we first and the other thing is

1060
00:47:51,680 --> 00:47:49,080
although Hubble has been boosted

1061
00:47:54,440 --> 00:47:51,690
slightly it's solar panels are so

1062
00:47:57,530 --> 00:47:54,450
fragile they can't just be moving it

1063
00:48:00,380 --> 00:47:57,540

around so the process of moving Hubble

1064
00:48:02,600 --> 00:48:00,390
is a very delicate thing and the

1065
00:48:04,280 --> 00:48:02,610
astronauts have done that they've done

1066
00:48:08,000 --> 00:48:04,290
it they've boosted with the shuttle

1067
00:48:11,110 --> 00:48:08,010
they've moved it out slightly but it's a

1068
00:48:14,720 --> 00:48:11,120
you know this stuff is very delicate

1069
00:48:17,450 --> 00:48:14,730
precise and you can really mess things

1070
00:48:21,350 --> 00:48:17,460
up by putting a propulsion system yeah

1071
00:48:22,790 --> 00:48:21,360
that's a way that's a way better yeah

1072
00:48:24,410 --> 00:48:22,800
that's a way better answer than the one

1073
00:48:27,830 --> 00:48:24,420
I was going to and then I make my flip

1074
00:48:29,750 --> 00:48:27,840
answer that I can't do so thank you okay

1075
00:48:32,650 --> 00:48:29,760
Scott thank you for where you go here it

1076
00:48:36,380 --> 00:48:32,660
is folks this is my favorite image ever

1077
00:48:38,120 --> 00:48:36,390
this you get the image itself while it's

1078
00:48:40,220 --> 00:48:38,130
pretty and there's a bunch of smudges

1079
00:48:43,200 --> 00:48:40,230
and smears everywhere the thing about

1080
00:48:46,950 --> 00:48:43,210
this image that gets me every time is

1081
00:48:49,980 --> 00:48:46,960
it was taken and what it represents this

1082
00:48:51,870 --> 00:48:49,990
was taken in an area of sky weather we

1083
00:48:53,610 --> 00:48:51,880
didn't know anything was there it was a

1084
00:48:55,110 --> 00:48:53,620
dark area there were no stars in our

1085
00:48:57,860 --> 00:48:55,120
galaxy there were no other galaxies cuz

1086
00:49:00,420 --> 00:48:57,870
we knew of in the way this was a black

1087
00:49:03,420 --> 00:49:00,430
patch of sky where nothing was ever

1088
00:49:08,250 --> 00:49:03,430

thought to be and when they exposed the

1089
00:49:09,750 --> 00:49:08,260
telescope they saw a frame filled with

1090
00:49:13,140 --> 00:49:09,760
galaxies there's eleven thousand

1091
00:49:15,720 --> 00:49:13,150
galaxies or so in here and we've we've

1092
00:49:18,390 --> 00:49:15,730
revisited this guy many many this place

1093
00:49:21,170 --> 00:49:18,400
many many times most recently last year

1094
00:49:23,430 --> 00:49:21,180
I think where we looked at it in the

1095
00:49:25,200 --> 00:49:23,440
ultraviolet we added ultraviolet

1096
00:49:26,940 --> 00:49:25,210
wavelengths and we saw a few more

1097
00:49:30,090 --> 00:49:26,950
galaxies and things like that and I just

1098
00:49:33,180 --> 00:49:30,100
this to me is still the most important

1099
00:49:34,590 --> 00:49:33,190
image ever taken and I don't know Carole

1100
00:49:36,180 --> 00:49:34,600
do you want to add some actual science

1101
00:49:39,990 --> 00:49:36,190
comments to that instead of a bunch of

1102
00:49:43,740 --> 00:49:40,000
good bunch of fluff that I just did okay

1103
00:49:47,190 --> 00:49:43,750
so the reason I had the importance of

1104
00:49:49,080 --> 00:49:47,200
doing do fields first of all you well of

1105
00:49:51,570 --> 00:49:49,090
course wanted push as deep as you can

1106
00:49:54,360 --> 00:49:51,580
back further and further in time and the

1107
00:49:59,700 --> 00:49:54,370
idea is one of the ideas is can you see

1108
00:50:01,500 --> 00:49:59,710
can you see galaxies forming way back so

1109
00:50:02,970 --> 00:50:01,510
number one so can you count them and

1110
00:50:05,900 --> 00:50:02,980
measure them so that's the first task

1111
00:50:08,850 --> 00:50:05,910
and you need multiple filters to do that

1112
00:50:10,980 --> 00:50:08,860
because we cannot use spectroscopy to

1113
00:50:14,640 --> 00:50:10,990

determine that the famous objects here

1114
00:50:16,770 --> 00:50:14,650
cannot be reached using spectroscopy so

1115
00:50:20,070 --> 00:50:16,780
we need to take images and filters to

1116
00:50:21,780 --> 00:50:20,080
the to guess at their distances the

1117
00:50:24,210 --> 00:50:21,790
other question is so there's the

1118
00:50:27,840 --> 00:50:24,220
distribution in space going outwards

1119
00:50:31,590 --> 00:50:27,850
from the earth and the other question

1120
00:50:34,140 --> 00:50:31,600
that one wants to ask is you see

1121
00:50:37,440 --> 00:50:34,150
morphologies of you know the spiral is

1122
00:50:40,110 --> 00:50:37,450
elliptical - of nearby galaxies is the

1123
00:50:43,440 --> 00:50:40,120
same thing happening how far back is the

1124
00:50:45,780 --> 00:50:43,450
same thing happening and what what how

1125
00:50:48,270 --> 00:50:45,790
where galaxies first formed with a small

1126
00:50:50,850 --> 00:50:48,280
little pieces that ran into together or

1127
00:50:52,650 --> 00:50:50,860
are large galaxies formed as large

1128
00:50:54,660 --> 00:50:52,660
galaxies did they start out as large

1129
00:50:55,730 --> 00:50:54,670
galaxies and they're always like that or

1130
00:50:58,940 --> 00:50:55,740
what in a

1131
00:51:00,800 --> 00:50:58,950
so it's likely that galaxies actually

1132
00:51:03,530 --> 00:51:00,810
formed from small bits and pieces

1133
00:51:06,650 --> 00:51:03,540
although curiously enough there are some

1134
00:51:08,570 --> 00:51:06,660
when you look back in time to the early

1135
00:51:11,150 --> 00:51:08,580
universe there are some very massive

1136
00:51:13,400 --> 00:51:11,160
galaxies even back then so there there

1137
00:51:15,230 --> 00:51:13,410
may have been pockets of material that

1138
00:51:19,670 --> 00:51:15,240

formed very large galaxies and in other

1139
00:51:21,290 --> 00:51:19,680
places little ones that later merge let

1140
00:51:23,810 --> 00:51:21,300
me just remind you guys that we did a

1141
00:51:25,370 --> 00:51:23,820
hangout with Massimo Steve Ali a couple

1142
00:51:27,680 --> 00:51:25,380
of weeks ago where we talked about the

1143
00:51:29,660 --> 00:51:27,690
earliest galaxies in their first star so

1144
00:51:33,740 --> 00:51:29,670
he gave us a lot of good information on

1145
00:51:35,690 --> 00:51:33,750
that as well Judy Schmidt hi Judy the

1146
00:51:38,230 --> 00:51:35,700
solar panels are not attached very

1147
00:51:41,960 --> 00:51:38,240
strongly to the telescope question mark

1148
00:51:43,790 --> 00:51:41,970
apparently they are they are robustly

1149
00:51:47,630 --> 00:51:43,800
attached to this house scope but they

1150
00:51:52,940 --> 00:51:47,640
are large extended pieces of mylar right

1151
00:51:55,400 --> 00:51:52,950
so take a huge piece of mylar and you

1152
00:51:57,920 --> 00:51:55,410
know leave it out in space and it's

1153
00:51:59,359 --> 00:51:57,930
gonna flop as it as a telescope to scale

1154
00:52:01,579 --> 00:51:59,369
I mean there's a little bit about

1155
00:52:04,070 --> 00:52:01,589
missing up there and so is going to be

1156
00:52:06,020 --> 00:52:04,080
affected by that and so they do they

1157
00:52:08,870 --> 00:52:06,030
move and in fact they were replaced by

1158
00:52:12,290 --> 00:52:08,880
smaller solar panels because the large

1159
00:52:14,960 --> 00:52:12,300
ones had some problems so solar panels

1160
00:52:16,810 --> 00:52:14,970
are an interesting technology and if

1161
00:52:20,720 --> 00:52:16,820
you're gonna have the stretched out

1162
00:52:22,160 --> 00:52:20,730
lightweight so you can launch it yeah

1163
00:52:23,900 --> 00:52:22,170

they're robustly attached to the

1164
00:52:27,710 --> 00:52:23,910
telescope but you can't be just shoving

1165
00:52:30,020 --> 00:52:27,720
them around in space they're very

1166
00:52:31,940 --> 00:52:30,030
delicate but they're built for being in

1167
00:52:33,680 --> 00:52:31,950
low-earth orbit and maintaining that so

1168
00:52:35,750 --> 00:52:33,690
if you're attaching it to another

1169
00:52:38,570 --> 00:52:35,760
spacecraft and putting that sort of

1170
00:52:41,570 --> 00:52:38,580
force on gap butter by just just the

1171
00:52:44,690 --> 00:52:41,580
acceleration it's not it wasn't built to

1172
00:52:52,160 --> 00:52:44,700
be on there so it's peering point of

1173
00:52:55,460 --> 00:52:52,170
view it's not so I do I am compelled to

1174
00:53:00,579 --> 00:52:55,470
show because you know preempted my story

1175
00:53:04,930 --> 00:53:00,589
I would like to show the galaxy m83

1176
00:53:07,700 --> 00:53:04,940
which isn't and there's a point there

1177
00:53:10,450 --> 00:53:07,710
okay two more things I want to show one

1178
00:53:12,830 --> 00:53:10,460
is that 93

1179
00:53:13,430 --> 00:53:12,840
you know we have email before the show

1180
00:53:21,770 --> 00:53:13,440
right

1181
00:53:27,710 --> 00:53:21,780
we while we get our our ducks in a row

1182
00:53:30,200 --> 00:53:27,720
they're Tiberias Maximus what amazing

1183
00:53:33,230 --> 00:53:30,210
breakthrough is it that a straw makes

1184
00:53:34,340 --> 00:53:33,240
astronomers most excited for 2015

1185
00:53:36,950 --> 00:53:34,350
I don't know Carol are you looking

1186
00:53:38,359 --> 00:53:36,960
forward anything this year me it's

1187
00:53:44,510 --> 00:53:38,369
frontier fields I like all that I like

1188
00:53:46,700 --> 00:53:44,520

watching all frontier fields but you

1189
00:53:50,660 --> 00:53:46,710
know I I don't I don't like choosing the

1190
00:53:58,250 --> 00:53:50,670
best oh well could you use me all the

1191
00:54:01,070 --> 00:53:58,260
time I'll just choose you know everyone

1192
00:54:02,990 --> 00:54:01,080
you know exoplanets planet there's all

1193
00:54:06,550 --> 00:54:03,000
kinds of things going on that is

1194
00:54:09,440 --> 00:54:06,560
research and all of its spectacular yes

1195
00:54:11,540 --> 00:54:09,450
because I believe that all these lines

1196
00:54:15,620 --> 00:54:11,550
of Investigation and they're all also

1197
00:54:17,510 --> 00:54:15,630
connected so so Anna and I want to try

1198
00:54:19,310 --> 00:54:17,520
to sell that story to you because we

1199
00:54:21,470 --> 00:54:19,320
have talked about the Orion Nebula we've

1200
00:54:25,060 --> 00:54:21,480
talked about supernovae exploding and

1201
00:54:29,930 --> 00:54:25,070
pushing material into other materials

1202
00:54:32,330 --> 00:54:29,940
forming star clusters like 3603 and the

1203
00:54:33,770 --> 00:54:32,340
tarantula nebula and here's a galaxy

1204
00:54:35,960 --> 00:54:33,780
that we're looking at and this kind of

1205
00:54:37,940 --> 00:54:35,970
thing is going on all over this galaxy I

1206
00:54:40,700 --> 00:54:37,950
mean there's all kinds of star formation

1207
00:54:42,320 --> 00:54:40,710
regions there's one cluster and you know

1208
00:54:42,950 --> 00:54:42,330
you can see over kind of in the mid

1209
00:54:45,260 --> 00:54:42,960
length

1210
00:54:47,210 --> 00:54:45,270
there's a bubble a cluster with a bubble

1211
00:54:50,210 --> 00:54:47,220
exactly that's what's happening only

1212
00:54:51,980 --> 00:54:50,220
it's a distant galaxy and so that star

1213
00:54:53,480 --> 00:54:51,990

cluster is pushing its material out it's

1214
00:54:54,950 --> 00:54:53,490
running into that other material and

1215
00:54:58,760 --> 00:54:54,960
there's going to be new star clusters

1216
00:55:01,120 --> 00:54:58,770
forming and so it was you know the whole

1217
00:55:03,380 --> 00:55:01,130
part of the story and this is considered

1218
00:55:07,250 --> 00:55:03,390
even though this galaxy is pretty far

1219
00:55:09,920 --> 00:55:07,260
away in the cosmic scale this isn't

1220
00:55:11,750 --> 00:55:09,930
quick quote a nearby galaxy and we can

1221
00:55:14,630 --> 00:55:11,760
see the star clusters and we can count

1222
00:55:17,000 --> 00:55:14,640
them and we can see how they are related

1223
00:55:19,780 --> 00:55:17,010
to the overall spiral structure and so

1224
00:55:22,220 --> 00:55:19,790
the next step of the story was well

1225
00:55:22,970 --> 00:55:22,230
although there's an intermediate step

1226
00:55:26,020 --> 00:55:22,980
zona

1227
00:55:29,660 --> 00:55:26,030
ask you to show another another image

1228
00:55:32,330 --> 00:55:29,670
the question about the HDF is okay we

1229
00:55:34,580 --> 00:55:32,340
see these spiral galaxies and elliptical

1230
00:55:36,500 --> 00:55:34,590
galaxies is that what's going on in the

1231
00:55:39,770 --> 00:55:36,510
distant universe and that was the point

1232
00:55:41,690 --> 00:55:39,780
of doing the Hubble Deep fields is to

1233
00:55:45,230 --> 00:55:41,700
find out if galaxies like we see today

1234
00:55:48,140 --> 00:55:45,240
are forming in the early universe and it

1235
00:55:50,650 --> 00:55:48,150
looks like pretty far back they are but

1236
00:55:54,380 --> 00:55:50,660
then at some point this grand design

1237
00:55:56,210 --> 00:55:54,390
type of formation was not happening and

1238
00:55:59,260 --> 00:55:56,220

it probably was built up from little

1239
00:56:09,710 --> 00:55:59,270
tiny pieces so the last one which you

1240
00:56:12,290 --> 00:56:09,720
have in your list is ARP 273 and and

1241
00:56:15,830 --> 00:56:12,300
this is another piece of the puzzle so

1242
00:56:18,680 --> 00:56:15,840
this three actually three galaxies here

1243
00:56:21,680 --> 00:56:18,690
there's there's the large spiral galaxy

1244
00:56:24,830 --> 00:56:21,690
you see there's one below and then up on

1245
00:56:28,820 --> 00:56:24,840
the right Gordon there's another galaxy

1246
00:56:31,040 --> 00:56:28,830
and so part of the clue of this

1247
00:56:34,280 --> 00:56:31,050
happening with the star formation being

1248
00:56:36,920 --> 00:56:34,290
triggered all over a galaxy is that

1249
00:56:40,820 --> 00:56:36,930
there's a lot there are many galaxies

1250
00:56:43,010 --> 00:56:40,830
that interact and produce these spiral

1251
00:56:45,080 --> 00:56:43,020
patterns and produce all the star

1252
00:56:47,030 --> 00:56:45,090
formation and it's a lucky thing because

1253
00:56:49,820 --> 00:56:47,040
we wouldn't be here without supernova

1254
00:56:52,820 --> 00:56:49,830
and star formation and exoplanets and

1255
00:56:54,410 --> 00:56:52,830
all that so it is a thread and that's

1256
00:56:56,470 --> 00:56:54,420
why it's hard for me to choose one thing

1257
00:56:58,970 --> 00:56:56,480
because these things are all related and

1258
00:57:00,980 --> 00:56:58,980
you need to understand every piece of

1259
00:57:07,220 --> 00:57:00,990
this to actually understand the whole

1260
00:57:08,690 --> 00:57:07,230
universe that woman very good okay all

1261
00:57:10,970 --> 00:57:08,700
right we've got three minutes and a

1262
00:57:13,730 --> 00:57:10,980
bunch of questions I'm on I want to give

1263
00:57:15,380 --> 00:57:13,740

one to Lucas Skywalker from YouTube I

1264
00:57:18,080 --> 00:57:15,390
have a question because it is quite

1265
00:57:21,200 --> 00:57:18,090
confusing with naked eyes we cannot see

1266
00:57:23,240 --> 00:57:21,210
a real nebula how it looks right we need

1267
00:57:26,120 --> 00:57:23,250
the same filter that Hubble that the

1268
00:57:27,830 --> 00:57:26,130
Hubble telescope has but actually how it

1269
00:57:29,359 --> 00:57:27,840
looks like out there without so what

1270
00:57:32,540 --> 00:57:29,369
does it look like without any filters

1271
00:57:34,820 --> 00:57:32,550
are there any real images in other words

1272
00:57:36,440 --> 00:57:34,830
what's the how do I guess I think the

1273
00:57:38,569 --> 00:57:36,450
spirit of this question is

1274
00:57:40,370 --> 00:57:38,579
we're kind of not looking at the same

1275
00:57:42,920 --> 00:57:40,380
thing like it really is if we looked up

1276
00:57:47,150 --> 00:57:42,930
at the sky with our own eyes they tried

1277
00:57:49,509 --> 00:57:47,160
to see this nebulous and amateurs

1278
00:57:52,160 --> 00:57:49,519
amateurs take pictures all the time

1279
00:57:54,650 --> 00:57:52,170
especially like the Orion is a perfect

1280
00:57:57,440 --> 00:57:54,660
example right that's an example but it

1281
00:58:00,289 --> 00:57:57,450
isn't as rich because you don't get your

1282
00:58:01,910 --> 00:58:00,299
I cannot respond to all of the

1283
00:58:04,430 --> 00:58:01,920
wavelengths and it cannot disturb

1284
00:58:06,380 --> 00:58:04,440
discriminate between the carbon and

1285
00:58:11,390 --> 00:58:06,390
nitrogen the oxygen or what the colors

1286
00:58:13,819 --> 00:58:11,400
of the stars are so for sight we do we

1287
00:58:16,910 --> 00:58:13,829
take images in different colors not for

1288
00:58:20,269 --> 00:58:16,920

the glory of making pretty pictures but

1289
00:58:25,789 --> 00:58:20,279
to do science and we need the filters to

1290
00:58:28,099 --> 00:58:25,799
do robust science and so we make the the

1291
00:58:30,049 --> 00:58:28,109
color images to demonstrate the

1292
00:58:32,029 --> 00:58:30,059
astrophysics but the real measurements

1293
00:58:33,620 --> 00:58:32,039
come from the individual frames so if

1294
00:58:36,200 --> 00:58:33,630
you just go out in space you will not

1295
00:58:38,599 --> 00:58:36,210
see the same dynamic range things are

1296
00:58:40,279 --> 00:58:38,609
just kind of gray they usually are not

1297
00:58:42,349 --> 00:58:40,289
very when you look up at the night sky

1298
00:58:44,930 --> 00:58:42,359
there are a couple stars that you can

1299
00:58:46,819 --> 00:58:44,940
see that have color that write Rigel and

1300
00:58:48,620 --> 00:58:46,829
baitul juice and you can tell that if

1301
00:58:51,049 --> 00:58:48,630
you you're careful you can tell that

1302
00:58:53,180 --> 00:58:51,059
Mars is reddish but we don't have the

1303
00:58:55,970 --> 00:58:53,190
same discrimination and in dynamic range

1304
00:58:59,299 --> 00:58:55,980
in our eyes and so if we just showed you

1305
00:59:02,630 --> 00:58:59,309
the composite images you go hum okay

1306
00:59:06,440 --> 00:59:02,640
kind of interesting but even Hubble has

1307
00:59:08,839 --> 00:59:06,450
much more dynamic range and both

1308
00:59:10,670 --> 00:59:08,849
wavelength coverage and dynamic range so

1309
00:59:12,829 --> 00:59:10,680
it doesn't really represent what they

1310
00:59:14,859 --> 00:59:12,839
all would see it's much richer than that

1311
00:59:17,539 --> 00:59:14,869
because that's what we need for the song

1312
00:59:19,339 --> 00:59:17,549
okay well I guess we will we will leave

1313
00:59:20,660 --> 00:59:19,349

it there thank you Carol and thank you

1314
00:59:22,460 --> 00:59:20,670
for that question that was a good one I

1315
00:59:24,380 --> 00:59:22,470
gosh you guys this has been a fun

1316
00:59:26,420 --> 00:59:24,390
hangout I you guys were really active

1317
00:59:28,039 --> 00:59:26,430
thank you for leaving us questions and

1318
00:59:30,319 --> 00:59:28,049
comments and I tried to get to as many

1319
00:59:32,299 --> 00:59:30,329
as I could so I'm sorry if I didn't get

1320
00:59:34,819 --> 00:59:32,309
to all of them we've run out of time

1321
00:59:37,640 --> 00:59:34,829
before I sign off I do want to make one

1322
00:59:39,680 --> 00:59:37,650
no here just from Twitter Monique if

1323
00:59:41,359 --> 00:59:39,690
just says like every time I think Hubble

1324
00:59:43,190 --> 00:59:41,369
can't impress me any further they

1325
00:59:47,430 --> 00:59:43,200
release another stunning picture that

1326
00:59:50,130 --> 00:59:47,440
makes me speechless angry I

1327
00:59:52,200 --> 00:59:50,140
even being someone on the inside the

1328
00:59:56,640 --> 00:59:52,210
same thing goes whenever I see something

1329
00:59:59,400 --> 00:59:56,650
new that's coming out like what how ok I

1330
01:00:01,620 --> 00:59:59,410
like I get to be excited all the time

1331
01:00:03,410 --> 01:00:01,630
about the new things that were going on

1332
01:00:07,380 --> 01:00:03,420
with it you know the ultra deep field

1333
01:00:10,819 --> 01:00:07,390
with UV that that damned Raman one with

1334
01:00:15,539 --> 01:00:10,829
a smiley face I thought that was amazing

1335
01:00:18,809 --> 01:00:15,549
that was a very popular image you got a

1336
01:00:22,049 --> 01:00:18,819
lot of great you know a lot of people

1337
01:00:24,420 --> 01:00:22,059
talking about it I mean ring is and how

1338
01:00:25,950 --> 01:00:24,430

it really digs into things like frontier

1339
01:00:28,559 --> 01:00:25,960
fields and understanding gravitational

1340
01:00:30,329 --> 01:00:28,569
lensing and so I think it's great that

1341
01:00:32,940 --> 01:00:30,339
not only is it beautiful but we can

1342
01:00:36,000 --> 01:00:32,950
learn so much from it in the same

1343
01:00:37,349 --> 01:00:36,010
process it's much more to come so on

1344
01:00:39,029 --> 01:00:37,359
that very positive note we're gonna

1345
01:00:41,520 --> 01:00:39,039
close our hangout I want to remind

1346
01:00:44,130 --> 01:00:41,530
everybody there is a an ode to Hubble

1347
01:00:46,589 --> 01:00:44,140
video contest going on right now at ISA

1348
01:00:48,420 --> 01:00:46,599
at ISA space telescope org I have the

1349
01:00:50,220 --> 01:00:48,430
link also in the description box so go

1350
01:00:51,750 --> 01:00:50,230
and check it out and leave a video make

1351
01:00:53,789 --> 01:00:51,760
a video about telling us some of these

1352
01:00:55,109 --> 01:00:53,799
things like what what sky just read from

1353
01:00:57,480 --> 01:00:55,119
Twitter so we'd like to see your video

1354
01:00:59,250 --> 01:00:57,490
so don't forget that next week's hangout

1355
01:01:01,140 --> 01:00:59,260
on Thursday at 3 o'clock we're gonna be

1356
01:01:05,849 --> 01:01:01,150
looking at the granddaddy of all debris

1357
01:01:06,960 --> 01:01:05,859
disks in a pic Taurus and we've got a

1358
01:01:08,519 --> 01:01:06,970
lot of it we've got a press release

1359
01:01:09,809 --> 01:01:08,529
coming out on Thursday about this we'll

1360
01:01:11,640 --> 01:01:09,819
have the principal investigators

1361
01:01:14,069 --> 01:01:11,650
announcing some new research from Hubble

1362
01:01:15,720 --> 01:01:14,079
on all you wanted to know about debris

1363
01:01:18,480 --> 01:01:15,730

disks so we hope they'll see you there

1364
01:01:19,859 --> 01:01:18,490
thank you all for watching this has been

1365
01:01:21,539 --> 01:01:19,869
one of the funnest ones we've ever done