

1
00:00:04,899 --> 00:00:09,048
hello everybody and welcome to this

2
00:00:07,219 --> 00:00:10,609
week's Hubble hang out my name is Tony

3
00:00:09,048 --> 00:00:12,019
Darnell I work at the Space Telescope

4
00:00:10,609 --> 00:00:14,088
Science Institute and we've done it

5
00:00:12,019 --> 00:00:15,708
again we've got another great Hubble

6
00:00:14,089 --> 00:00:17,390
hangout plan for you this week

7
00:00:15,708 --> 00:00:19,640
astronomers using the Hubble Space

8
00:00:17,390 --> 00:00:22,640
Telescope have generated the most

9
00:00:19,640 --> 00:00:25,190
accurate statistical description yet of

10
00:00:22,640 --> 00:00:28,010
faint early galaxies as they existed in

11
00:00:25,190 --> 00:00:29,359
the universe 500 million years after the

12
00:00:28,010 --> 00:00:31,730
Big Bang we're going to talk about these

13
00:00:29,359 --> 00:00:33,140
findings in just a little bit with the

14
00:00:31,730 --> 00:00:36,710
sum of the astronomers that have made

15
00:00:33,140 --> 00:00:39,320
these these analyses public to us but

16
00:00:36,710 --> 00:00:41,149
before I get started I got something I

17
00:00:39,320 --> 00:00:44,600
want to say real quick I just found this

18
00:00:41,149 --> 00:00:46,009
out yesterday now sometimes before a hub

19
00:00:44,600 --> 00:00:47,840
will hang out what I'll do is I'll go on

20
00:00:46,009 --> 00:00:48,769
periscope and i'll do a hubble Q&A and

21
00:00:47,840 --> 00:00:50,030
i'll talk with you guys a little bit

22
00:00:48,770 --> 00:00:51,649
maybe to get some people jazzed up about

23
00:00:50,030 --> 00:00:53,870
the hangout but it always is that

24
00:00:51,649 --> 00:00:55,160
turning into a sort of a JWST Q&A more

25
00:00:53,869 --> 00:00:56,809
than that because everybody's interested

26
00:00:55,159 --> 00:00:58,459
about the new mission and how it's

27
00:00:56,810 --> 00:01:00,739
coming up how it's coming along and

28
00:00:58,460 --> 00:01:02,450
everybody always at some point we'll ask

29

00:01:00,738 --> 00:01:04,789
me the same question aren't we worried

30
00:01:02,450 --> 00:01:06,469
about launching jwst out at the l2 point

31
00:01:04,789 --> 00:01:07,608
and what if something get what if it

32
00:01:06,468 --> 00:01:09,678
gets hit by something or what if

33
00:01:07,608 --> 00:01:11,178
something goes wrong with it and it

34
00:01:09,679 --> 00:01:13,340
occurred to me yesterday that you know

35
00:01:11,179 --> 00:01:15,079
this is actually a solved problem we

36
00:01:13,340 --> 00:01:16,700
solved this problem because there's a

37
00:01:15,078 --> 00:01:19,009
when I first started my career in

38
00:01:16,700 --> 00:01:21,469
astronomy I started in the solar physics

39
00:01:19,009 --> 00:01:23,388
area and there's a there is a spacecraft

40
00:01:21,468 --> 00:01:26,928
that we launched back in let's see

41
00:01:23,388 --> 00:01:28,218
December second 1995 and it was built by

42
00:01:26,929 --> 00:01:30,439
the Europeans and operated by the

43
00:01:28,218 --> 00:01:32,478

European Space Agency but NASA had like

44

00:01:30,438 --> 00:01:34,548

12 or 13 instruments on it as well and

45

00:01:32,478 --> 00:01:36,888

they put it out the L1 point which is

46

00:01:34,549 --> 00:01:39,380

this point in between Earth and the Sun

47

00:01:36,888 --> 00:01:40,699

we're going to put JWST at L2 which is a

48

00:01:39,379 --> 00:01:42,349

million miles away and it's behind the

49

00:01:40,700 --> 00:01:44,959

earth so it's you know it's at a pretty

50

00:01:42,349 --> 00:01:46,998

far away no repair missions were planned

51

00:01:44,959 --> 00:01:50,840

it was it's been up there for nine years

52

00:01:46,998 --> 00:01:52,728

nine months and 29 days and but more

53

00:01:50,840 --> 00:01:53,990

than that it's been sitting like I said

54

00:01:52,728 --> 00:01:56,688

at the L1 point where it's in between

55

00:01:53,989 --> 00:01:58,789

the Sun and the earth where it is

56

00:01:56,688 --> 00:02:02,118

getting bombarded by coronal mass

57

00:01:58,789 --> 00:02:03,349

ejections on a regular basis while it

58
00:02:02,118 --> 00:02:04,578
measures and looks at the Sun it has a

59
00:02:03,349 --> 00:02:07,609
lot of instruments that looks at this

60
00:02:04,578 --> 00:02:09,288
the chromospheric iron 9 12 and 13

61
00:02:07,608 --> 00:02:12,859
something like that it also has three

62
00:02:09,288 --> 00:02:13,849
chronographs on board lasko c1 c2 and c3

63
00:02:12,860 --> 00:02:16,070
now that

64
00:02:13,849 --> 00:02:17,780
you see one very much but c2 and c3 I

65
00:02:16,069 --> 00:02:20,900
was I was poking around on the web page

66
00:02:17,780 --> 00:02:24,919
today just discovered discovered not

67
00:02:20,900 --> 00:02:27,469
observed but discovered it's 3,000 comet

68
00:02:24,919 --> 00:02:29,359
so it has been up there for a long time

69
00:02:27,469 --> 00:02:32,030
so we've got we this there's a precedent

70
00:02:29,360 --> 00:02:34,040
for this no repair missions now Hubble's

71
00:02:32,030 --> 00:02:35,689
great we spend every week talking about

72
00:02:34,039 --> 00:02:38,239
how great Hubble is we're celebrating 25

73
00:02:35,689 --> 00:02:39,800
years of Hubble being in orbit this year

74
00:02:38,240 --> 00:02:41,210
which is an amazing feat as the longest

75
00:02:39,800 --> 00:02:44,060
space telescope to ever have done that

76
00:02:41,210 --> 00:02:46,010
but Soho the solar Heliospheric

77
00:02:44,060 --> 00:02:50,719
Observatory has been up there will be

78
00:02:46,009 --> 00:02:53,269
Ted it will be there 10 years or no yeah

79
00:02:50,719 --> 00:02:55,310
20 years actually because this is 2015

80
00:02:53,270 --> 00:02:58,460
I'm sorry I have that wrong 19 years to

81
00:02:55,310 --> 00:03:00,140
spin up now so 20 years this december

82
00:02:58,460 --> 00:03:01,670
five years after the launch of Hubble

83
00:03:00,139 --> 00:03:03,919
Space Telescope they launched so huh so

84
00:03:01,669 --> 00:03:06,049
the next time you get all bent out of

85
00:03:03,919 --> 00:03:07,639
shape about ELQ JWST being a tell to

86

00:03:06,050 --> 00:03:09,170
think about that for a second because I

87
00:03:07,639 --> 00:03:10,819
think this is more of a solved

88
00:03:09,169 --> 00:03:13,219
engineering problem than anything else

89
00:03:10,819 --> 00:03:15,799
so I just had to get that out cuz you

90
00:03:13,219 --> 00:03:17,469
know i don't i don't know about I don't

91
00:03:15,800 --> 00:03:23,060
know about don't get bent out of shape

92
00:03:17,469 --> 00:03:24,259
little Tommy s'okay ok got it all right

93
00:03:23,060 --> 00:03:26,479
so let's get start with the tweet hang

94
00:03:24,259 --> 00:03:27,679
out I was related to a previous

95
00:03:26,479 --> 00:03:30,079
conversation we had so I wanted to get

96
00:03:27,680 --> 00:03:32,390
that out with me as she is every week

97
00:03:30,080 --> 00:03:34,340
always making fun of me and my colleague

98
00:03:32,389 --> 00:03:36,739
and friend dr. carol christian she is

99
00:03:34,340 --> 00:03:39,020
the oh let's go power each project

100
00:03:36,740 --> 00:03:40,550

scientist hi Carol welcome back glad to

101

00:03:39,020 --> 00:03:44,090

see you're in good form again thank you

102

00:03:40,550 --> 00:03:46,460

so much oh you're so welcome also also

103

00:03:44,090 --> 00:03:48,710

joining us as he does each week is the

104

00:03:46,460 --> 00:03:50,330

the md eminent scott lewis internet

105

00:03:48,710 --> 00:03:52,790

driver extraordinaire hi scott welcome

106

00:03:50,330 --> 00:03:55,010

back thank you Tony and and honestly get

107

00:03:52,789 --> 00:03:57,889

to defend Carole which I don't often do

108

00:03:55,009 --> 00:04:00,859

um it's far too easy to make fun of you

109

00:03:57,889 --> 00:04:04,789

ah this / so sure she gotta work just

110

00:04:00,860 --> 00:04:08,030

like it's low-hanging it's a mentally

111

00:04:04,789 --> 00:04:12,189

target okay that's all right payback is

112

00:04:08,030 --> 00:04:14,870

a you know what so okay all right guys I

113

00:04:12,189 --> 00:04:17,060

I see how it's gonna be but the thing

114

00:04:14,870 --> 00:04:19,790

you should work on your dog by the time

115
00:04:17,060 --> 00:04:21,108
it happens yes he's Denver you're going

116
00:04:19,790 --> 00:04:23,180
to be hearing all about you're gonna be

117
00:04:21,108 --> 00:04:24,769
hearing all about soho 20 years now if i

118
00:04:23,180 --> 00:04:27,459
were there EPO I'd be getting ready for

119
00:04:24,769 --> 00:04:29,859
a big party but anyway okay so

120
00:04:27,459 --> 00:04:31,839
as I mentioned we back back to Hubble

121
00:04:29,860 --> 00:04:34,660
and using the Hubble data astronomers at

122
00:04:31,839 --> 00:04:37,149
UC Irvine and other places have been

123
00:04:34,660 --> 00:04:39,039
using Hubble data to like I said look at

124
00:04:37,149 --> 00:04:40,959
the earliest galaxies in the universe

125
00:04:39,038 --> 00:04:43,089
which is way better than the Sun in my

126
00:04:40,959 --> 00:04:47,138
opinion also way better than anything of

127
00:04:43,089 --> 00:04:48,728
my my the subject I covet the most early

128
00:04:47,139 --> 00:04:50,470
galaxies in the universe and with me to

129
00:04:48,728 --> 00:04:52,359
talk about this is dr. Stevens

130
00:04:50,470 --> 00:04:53,800
Finkelstein Einstein he's driest Rana

131
00:04:52,360 --> 00:04:56,319
Murr at the University of Texas at

132
00:04:53,800 --> 00:04:58,150
Austin hi Steve welcome back this is

133
00:04:56,319 --> 00:05:00,430
like you're gonna be a regular here

134
00:04:58,149 --> 00:05:02,228
on our hangouts yeah hey D'Antoni you're

135
00:05:00,430 --> 00:05:04,709
really good thank you & cat also joining

136
00:05:02,228 --> 00:05:08,379
me is a catcher in Mitchell when he is a

137
00:05:04,709 --> 00:05:10,029
PhD student at the UC Irvine he was part

138
00:05:08,379 --> 00:05:12,759
of the study that we're going that came

139
00:05:10,029 --> 00:05:14,769
out in I guess it was earlier this month

140
00:05:12,759 --> 00:05:17,500
right Katherine that's right yeah well

141
00:05:14,769 --> 00:05:19,180
last was a journal nature what was it

142
00:05:17,500 --> 00:05:21,459
called nature supplement or something

143

00:05:19,180 --> 00:05:23,829
like that nature communications that's

144
00:05:21,459 --> 00:05:25,810
what it was okay so let's take a before

145
00:05:23,829 --> 00:05:29,139
we get to your actual observations and

146
00:05:25,810 --> 00:05:31,060
the results from them let's take a step

147
00:05:29,139 --> 00:05:32,560
back and talk about something that the

148
00:05:31,060 --> 00:05:35,709
Hubble has been doing for quite a while

149
00:05:32,560 --> 00:05:39,250
which is these surveys these are sort of

150
00:05:35,709 --> 00:05:41,469
designed program observation programs

151
00:05:39,250 --> 00:05:44,079
that that Hubble does periodic leaders

152
00:05:41,470 --> 00:05:45,909
that they've been doing these with right

153
00:05:44,079 --> 00:05:47,408
now with the main one going on is called

154
00:05:45,908 --> 00:05:49,180
frontier fields just looking at six

155
00:05:47,408 --> 00:05:50,769
different areas of the sky but before

156
00:05:49,180 --> 00:05:52,959
that there was another one called clash

157
00:05:50,769 --> 00:05:56,589

and before that was one called candles

158

00:05:52,959 --> 00:05:59,769
which is the cosmic assembly

159

00:05:56,589 --> 00:06:02,408
near-infrared deep extra galactic legacy

160

00:05:59,769 --> 00:06:03,968
survey somehow that just things that

161

00:06:02,408 --> 00:06:05,680
they were trying to make that work but

162

00:06:03,968 --> 00:06:07,360
anyway that's at candles that's how

163

00:06:05,680 --> 00:06:09,389
that's what candles is it you guys use

164

00:06:07,360 --> 00:06:13,870
candles data for the survey right Katrin

165

00:06:09,389 --> 00:06:16,930
yeah that's right okay so this wasn't as

166

00:06:13,870 --> 00:06:18,668
data set that was designed for what it

167

00:06:16,930 --> 00:06:21,038
wasn't for you specifically to do this

168

00:06:18,668 --> 00:06:23,709
work but you found that it was work it

169

00:06:21,038 --> 00:06:26,399
was observations that sort of enabled

170

00:06:23,709 --> 00:06:29,769
your work correct yeah we had to do this

171

00:06:26,399 --> 00:06:33,370
complex mosaicing technique called

172
00:06:29,769 --> 00:06:35,620
self-calibration and yeah the kid the

173
00:06:33,370 --> 00:06:40,269
candles data was collected in such a way

174
00:06:35,620 --> 00:06:41,288
to maximize I think the area but for us

175
00:06:40,269 --> 00:06:44,198
that's not necessarily

176
00:06:41,288 --> 00:06:45,848
we want but when we supplemented the

177
00:06:44,199 --> 00:06:48,129
candles data with archived data we had

178
00:06:45,848 --> 00:06:49,808
plenty to work with oh really so you use

179
00:06:48,129 --> 00:06:51,338
also data from the archive as well okay

180
00:06:49,809 --> 00:06:52,689
Steve language what keep wondering why

181
00:06:51,338 --> 00:06:56,228
don't you describe candles force first

182
00:06:52,689 --> 00:06:57,369
can we start there yeah sure so so

183
00:06:56,228 --> 00:06:59,109
candles you already spell out the

184
00:06:57,369 --> 00:07:01,270
acronym it's a long reckoning but it's

185
00:06:59,110 --> 00:07:05,468
one of the largest if not the largest

186
00:07:01,269 --> 00:07:07,088
tuple program ever so back in the last

187
00:07:05,468 --> 00:07:09,430
decade there was a big program called

188
00:07:07,088 --> 00:07:11,259
goods which took optical imaging so

189
00:07:09,430 --> 00:07:12,848
visible light that our eyes can see it

190
00:07:11,259 --> 00:07:14,559
took those kind of images of a few

191
00:07:12,848 --> 00:07:16,718
regions of the sky and learned a lot of

192
00:07:14,559 --> 00:07:18,819
stuff about galaxies at at sort of

193
00:07:16,718 --> 00:07:21,038
moderate red shifts from time say two to

194
00:07:18,819 --> 00:07:23,559
two to 10 billion years after the Big

195
00:07:21,038 --> 00:07:25,118
Bang but if we want to go back closer to

196
00:07:23,559 --> 00:07:27,189
the big thing we need to look in the

197
00:07:25,119 --> 00:07:29,080
near-infrared because the expansion of

198
00:07:27,189 --> 00:07:30,759
the universe has red shifted all of the

199
00:07:29,079 --> 00:07:32,829
ultraviolet and the visible light of

200

00:07:30,759 --> 00:07:34,869
those very distant galaxies completely

201
00:07:32,829 --> 00:07:37,628
out of the optical into the infrared and

202
00:07:34,869 --> 00:07:39,669
so when Hubble installed or when Hubble

203
00:07:37,629 --> 00:07:42,278
when the astronauts installed why field

204
00:07:39,668 --> 00:07:45,218
camera 3 infrared camera on Hubble in

205
00:07:42,278 --> 00:07:47,228
2009 one of the most obvious things to

206
00:07:45,218 --> 00:07:50,079
do was to go and try and do a similar

207
00:07:47,228 --> 00:07:51,908
survey in the near infrared it does take

208
00:07:50,079 --> 00:07:53,668
a long time so there was a special call

209
00:07:51,908 --> 00:07:57,248
for very long proposals called

210
00:07:53,668 --> 00:07:58,508
multi-cycle Treasury programs and one of

211
00:07:57,249 --> 00:08:00,069
the ones that was selected was candles

212
00:07:58,509 --> 00:08:01,689
you also mentioned clash which looked at

213
00:08:00,069 --> 00:08:03,699
London clusters and also fat which

214
00:08:01,689 --> 00:08:05,709

looked at the Andromeda galaxy right we

215

00:08:03,699 --> 00:08:07,838

just had a recent hangout on well we've

216

00:08:05,709 --> 00:08:09,490

had hangouts on all of these but yeah so

217

00:08:07,838 --> 00:08:12,519

they're called multi-cycle Treasury

218

00:08:09,490 --> 00:08:14,259

programs that's right yeah and so

219

00:08:12,519 --> 00:08:17,709

candles the program candles looked at

220

00:08:14,259 --> 00:08:19,629

five different regions in the sky all

221

00:08:17,709 --> 00:08:22,478

together they're pretty small they are

222

00:08:19,629 --> 00:08:23,439

about one-fifth of a square degree so

223

00:08:22,478 --> 00:08:24,998

it's actually if you added them all

224

00:08:23,439 --> 00:08:27,189

together it's smaller than the area of

225

00:08:24,999 --> 00:08:29,439

the moon but for extra galactic surveys

226

00:08:27,189 --> 00:08:31,419

that's actually pretty huge and so the

227

00:08:29,439 --> 00:08:33,278

survey is now done the science is not

228

00:08:31,418 --> 00:08:34,629

done we're still actively working on

229
00:08:33,278 --> 00:08:36,698
papers like this great paper that

230
00:08:34,629 --> 00:08:38,259
Quechuan wrote but yeah we've been

231
00:08:36,698 --> 00:08:41,019
learning a lot of great stuff about the

232
00:08:38,259 --> 00:08:43,180
universe oh great ok I am remiss folks

233
00:08:41,019 --> 00:08:45,068
as Steve was talking I reminder I

234
00:08:43,179 --> 00:08:46,929
occurred to me that I have not told you

235
00:08:45,068 --> 00:08:48,039
that we want you to interact with us in

236
00:08:46,929 --> 00:08:49,989
this hangout we want you to ask

237
00:08:48,039 --> 00:08:51,519
questions and leave comments and you

238
00:08:49,990 --> 00:08:53,230
could do that in a variety of ways Scott

239
00:08:51,519 --> 00:08:54,759
if you're still around and I didn't lose

240
00:08:53,230 --> 00:08:56,740
you from laughing

241
00:08:54,759 --> 00:08:58,659
I mean could you could you could you

242
00:08:56,740 --> 00:09:00,269
please explain to these two are kind of

243
00:08:58,659 --> 00:09:02,829
viewers how they may interact with us

244
00:09:00,269 --> 00:09:04,809
absolutely so the best and easiest way

245
00:09:02,830 --> 00:09:06,879
for you to interact with us is while

246
00:09:04,809 --> 00:09:09,279
your life here on the bottom left screen

247
00:09:06,879 --> 00:09:10,539
on this stream is some yellow text it

248
00:09:09,279 --> 00:09:13,029
says that we are answering your

249
00:09:10,539 --> 00:09:15,219
questions live which we are so we have a

250
00:09:13,029 --> 00:09:16,659
Q&A app and we're able to see any

251
00:09:15,220 --> 00:09:18,490
questions or comments you leave there

252
00:09:16,659 --> 00:09:20,620
you can upload ones that other people

253
00:09:18,490 --> 00:09:21,970
have left and so if we see anything

254
00:09:20,620 --> 00:09:23,470
really interesting that we want to

255
00:09:21,970 --> 00:09:25,389
address we can click it it will

256
00:09:23,470 --> 00:09:27,370
timestamp it when we're answering that

257

00:09:25,389 --> 00:09:28,960
question so for those who are not

258
00:09:27,370 --> 00:09:32,019
watching live you can see when those are

259
00:09:28,960 --> 00:09:34,870
being answered we can also interact with

260
00:09:32,019 --> 00:09:37,960
us on Twitter so I'm live tweeting this

261
00:09:34,870 --> 00:09:40,629
from at Hubble telescope using the

262
00:09:37,960 --> 00:09:42,310
hashtag hubble hang out so please send

263
00:09:40,629 --> 00:09:45,189
us your questions and comments on

264
00:09:42,309 --> 00:09:46,899
Twitter using that and I will be if it's

265
00:09:45,190 --> 00:09:49,030
something really awesome i'll retweet it

266
00:09:46,899 --> 00:09:51,009
or will be responding to them on air and

267
00:09:49,029 --> 00:09:52,269
make sure to follow us because we're

268
00:09:51,009 --> 00:09:54,519
always putting out really important

269
00:09:52,269 --> 00:09:57,250
stuff there on twitter too and follow us

270
00:09:54,519 --> 00:09:59,799
over on on youtube we are hubble site

271
00:09:57,250 --> 00:10:01,899

channel on youtube and we're also on

272

00:09:59,799 --> 00:10:04,929

facebook so we have an event on facebook

273

00:10:01,899 --> 00:10:06,850

and we're also on instagram at official

274

00:10:04,929 --> 00:10:08,649

Hubble and you can see some awesome

275

00:10:06,850 --> 00:10:10,720

pictures and visuals that we put up

276

00:10:08,649 --> 00:10:12,730

there yes that's great and I have been

277

00:10:10,720 --> 00:10:14,410

remiss in getting some public some some

278

00:10:12,730 --> 00:10:15,789

pictures up on Instagram so thank you

279

00:10:14,409 --> 00:10:17,469

for mining about well I got you covered

280

00:10:15,789 --> 00:10:20,139

you of course you do that's why you're

281

00:10:17,470 --> 00:10:22,210

here yeah you got my back all right

282

00:10:20,139 --> 00:10:23,500

thank you all right so uh let's get back

283

00:10:22,210 --> 00:10:24,790

to these these moai want to talk a

284

00:10:23,500 --> 00:10:26,679

little bit more about these multi-cycle

285

00:10:24,789 --> 00:10:28,240

Treasury programs and Carol I just

286
00:10:26,679 --> 00:10:29,709
wondering can you is one of the things

287
00:10:28,240 --> 00:10:31,570
I've noticed with our hangout trenzas we

288
00:10:29,710 --> 00:10:33,160
do talk a lot about these various

289
00:10:31,570 --> 00:10:34,300
surveys we talk about fat before we've

290
00:10:33,159 --> 00:10:35,469
talked about we felt bout frontier

291
00:10:34,299 --> 00:10:37,419
fields many times and of course now

292
00:10:35,470 --> 00:10:40,450
we're on candles again is this kind of a

293
00:10:37,419 --> 00:10:42,519
trend do you think with using Hubble in

294
00:10:40,450 --> 00:10:44,379
this way where we're kind of setting

295
00:10:42,519 --> 00:10:47,019
aside blocks of time for Hubble to do

296
00:10:44,379 --> 00:10:50,139
very specific sort of large larger scale

297
00:10:47,019 --> 00:10:52,329
observations well it's it's a balance I

298
00:10:50,139 --> 00:10:55,840
mean when Hubble was first launched

299
00:10:52,330 --> 00:10:57,670
everybody wanted to use the observing

300
00:10:55,840 --> 00:11:01,740
time and there were lots of little

301
00:10:57,669 --> 00:11:04,479
projects and there are still many many

302
00:11:01,740 --> 00:11:06,100
projects that only use a few orbits

303
00:11:04,480 --> 00:11:08,560
because there's lots of interesting

304
00:11:06,100 --> 00:11:10,420
science like if you want to look at us

305
00:11:08,559 --> 00:11:12,759
epic exoplanet or you want to look at a

306
00:11:10,419 --> 00:11:16,569
stellar population of a specific galaxy

307
00:11:12,759 --> 00:11:20,379
but surveys also are important and it's

308
00:11:16,570 --> 00:11:23,290
it's also important to look at many

309
00:11:20,379 --> 00:11:26,620
objects in the survey mode using the

310
00:11:23,289 --> 00:11:29,409
same instrumentation and so the idea was

311
00:11:26,620 --> 00:11:32,169
that part of the time Hubble should be

312
00:11:29,409 --> 00:11:34,809
devoted to these multi-cycle Treasury

313
00:11:32,169 --> 00:11:36,189
programs the interesting thing about it

314

00:11:34,809 --> 00:11:39,429
is that the team is really responsible

315
00:11:36,190 --> 00:11:43,029
for the calibration and also the data

316
00:11:39,429 --> 00:11:44,859
becomes available very quickly because

317
00:11:43,028 --> 00:11:48,549
it's such a large amount of data so the

318
00:11:44,860 --> 00:11:50,379
team that proposes the observation gets

319
00:11:48,549 --> 00:11:52,539
first crack at it but they have to

320
00:11:50,379 --> 00:11:56,019
calibrate it and then put it out there

321
00:11:52,539 --> 00:11:58,778
in the archive to use and what's been

322
00:11:56,019 --> 00:12:00,759
found is that what the original team

323
00:11:58,778 --> 00:12:03,669
thought they were going to do they do

324
00:12:00,759 --> 00:12:06,009
but then lots of other science can be

325
00:12:03,669 --> 00:12:09,039
done because there are several fields

326
00:12:06,009 --> 00:12:12,100
that are looked at that are pretty much

327
00:12:09,039 --> 00:12:15,879
uniform and address either galaxies or

328
00:12:12,100 --> 00:12:18,100

or like fat the Andromeda galaxy and so

329

00:12:15,879 --> 00:12:21,129

there's lots and lots of information in

330

00:12:18,100 --> 00:12:23,440

those observations that can tell us

331

00:12:21,129 --> 00:12:27,100

about all kinds of astrophysics so they

332

00:12:23,440 --> 00:12:28,750

are very productive in time really good

333

00:12:27,100 --> 00:12:30,339

news observation yeah it sounds like a

334

00:12:28,750 --> 00:12:32,830

good use of public comment and the other

335

00:12:30,339 --> 00:12:35,980

thing is like it's kind of like we're

336

00:12:32,830 --> 00:12:37,629

always saying okay you know Hubble won't

337

00:12:35,980 --> 00:12:39,960

live forever it's been here 25 years

338

00:12:37,629 --> 00:12:43,629

what do we have to do with Hubble and

339

00:12:39,960 --> 00:12:45,670

1. we the Hubble project ask that of the

340

00:12:43,629 --> 00:12:47,740

community they said we want to do more

341

00:12:45,669 --> 00:12:50,019

surveys so it's a response to the

342

00:12:47,740 --> 00:12:51,549

community interest as well oh really i

343
00:12:50,019 --> 00:12:52,958
did not know well I said that explains

344
00:12:51,549 --> 00:12:54,789
why there's so many lately then I don't

345
00:12:52,958 --> 00:12:56,199
recall in the early stage at early days

346
00:12:54,789 --> 00:12:58,000
of Hubble course I've not been around as

347
00:12:56,200 --> 00:12:59,680
long but it seems me like this is sort

348
00:12:58,000 --> 00:13:01,570
of a trend now so that's good to know so

349
00:12:59,679 --> 00:13:03,639
Wow cuz you know what it started with

350
00:13:01,570 --> 00:13:06,339
your favorite observation that's right

351
00:13:03,639 --> 00:13:08,379
the hobby for you exact first one they

352
00:13:06,339 --> 00:13:10,690
want a pony looks the Deep Field you

353
00:13:08,379 --> 00:13:13,659
want to get started on that list I know

354
00:13:10,690 --> 00:13:15,459
okay I'm sorry are you all right I'll

355
00:13:13,659 --> 00:13:17,409
curb that but I will instead of talking

356
00:13:15,458 --> 00:13:18,759
about the Hubble Deep Field will talk

357
00:13:17,409 --> 00:13:20,829
about the deepest galaxies move that

358
00:13:18,759 --> 00:13:22,299
Hubble can see so which brings me to and

359
00:13:20,830 --> 00:13:24,759
as Carol's point as Carol

360
00:13:22,299 --> 00:13:26,769
to this candle survey was one of those

361
00:13:24,759 --> 00:13:28,809
things that had a lot of other science

362
00:13:26,769 --> 00:13:30,429
that could be done from it than what it

363
00:13:28,809 --> 00:13:32,099
wasn't originally intended from so

364
00:13:30,429 --> 00:13:34,809
Katherine tell us a little bit about

365
00:13:32,100 --> 00:13:37,139
what your work was I mean yet you

366
00:13:34,809 --> 00:13:39,039
started a little bit talking about this

367
00:13:37,139 --> 00:13:41,019
mosaicing technique that you were doing

368
00:13:39,039 --> 00:13:44,049
but tell us a little bit about how you

369
00:13:41,019 --> 00:13:49,329
started this and what the science was a

370
00:13:44,049 --> 00:13:52,419
driver behind it okay um all stuffed

371

00:13:49,330 --> 00:13:57,639
hours per day um I started working on

372
00:13:52,419 --> 00:14:03,279
two years ago so candles as in the near

373
00:13:57,639 --> 00:14:06,759
red bands if I'd Cara through P and we

374
00:14:03,279 --> 00:14:11,589
want how to love different way I think

375
00:14:06,759 --> 00:14:14,980
between the arc never so we want to be I

376
00:14:11,590 --> 00:14:16,450
ever okay so I'm getting we're getting

377
00:14:14,980 --> 00:14:18,700
are you guys hearing you're being really

378
00:14:16,450 --> 00:14:20,680
broke uppers it just me now I can hear

379
00:14:18,700 --> 00:14:21,820
idea yeah okay all right good so it

380
00:14:20,679 --> 00:14:23,799
sounds like you get your really broken

381
00:14:21,820 --> 00:14:25,210
up breaking up Katrin can you I don't

382
00:14:23,799 --> 00:14:27,759
know if there's a way to get on a wired

383
00:14:25,210 --> 00:14:28,870
connection or not or Barrois put your

384
00:14:27,759 --> 00:14:29,860
connecting your where you're breaking up

385
00:14:28,870 --> 00:14:34,029

and we can't understand what you're

386

00:14:29,860 --> 00:14:35,529
saying is they're all all right you

387

00:14:34,029 --> 00:14:37,120
could perhaps try getting out of the

388

00:14:35,529 --> 00:14:38,829
Hangout and coming back in or just

389

00:14:37,120 --> 00:14:39,909
trying to plug in a an Ethernet if

390

00:14:38,830 --> 00:14:42,280
you've got it i'm not sure if that's

391

00:14:39,909 --> 00:14:44,049
possible or not so while you're doing

392

00:14:42,279 --> 00:14:46,720
that so let me go to you Steve you have

393

00:14:44,049 --> 00:14:49,809
a sort we tell us a little about your

394

00:14:46,720 --> 00:14:52,480
role in this research and maybe maybe if

395

00:14:49,809 --> 00:14:55,239
you happen to know some of the science

396

00:14:52,480 --> 00:15:00,220
drivers early on behind it sure yeah so

397

00:14:55,240 --> 00:15:01,750
um the main thing we're after is how

398

00:15:00,220 --> 00:15:04,029
many galaxies are out there in the very

399

00:15:01,750 --> 00:15:07,210
distinct really how much light are they

400
00:15:04,029 --> 00:15:08,529
putting out because we want to know how

401
00:15:07,210 --> 00:15:10,930
something happens it's called

402
00:15:08,529 --> 00:15:12,459
reionization and so reionization is

403
00:15:10,929 --> 00:15:14,139
the process where the gas that's in

404
00:15:12,460 --> 00:15:16,259
between galaxies and the universe is

405
00:15:14,139 --> 00:15:18,759
filled with gas between at galaxies

406
00:15:16,259 --> 00:15:20,409
basically lost all their electrons so if

407
00:15:18,759 --> 00:15:22,539
this gas is mostly hydrogen which just

408
00:15:20,409 --> 00:15:23,799
has one electron when it's neutral but

409
00:15:22,539 --> 00:15:25,299
nowadays if you go out look at all that

410
00:15:23,799 --> 00:15:26,679
hydrogen gas between the galaxies is

411
00:15:25,299 --> 00:15:28,479
ionized they've lost their electrons

412
00:15:26,679 --> 00:15:30,789
it's just a proton and a neutron then

413
00:15:28,480 --> 00:15:34,090
just a proton just approach a bunch of

414
00:15:30,789 --> 00:15:36,129
protons yeah and so we think that that

415
00:15:34,090 --> 00:15:37,540
happened that process happen so

416
00:15:36,129 --> 00:15:39,279
we know I had to happen early on because

417
00:15:37,539 --> 00:15:40,269
we could look pretty far back you've

418
00:15:39,279 --> 00:15:42,129
been all the way out to a redshift of

419
00:15:40,269 --> 00:15:43,329
six or so just a little over a billion

420
00:15:42,129 --> 00:15:45,039
years after the Big Bang and everything

421
00:15:43,330 --> 00:15:46,480
is ionized and we know from our

422
00:15:45,039 --> 00:15:48,219
theoretical understanding that it had to

423
00:15:46,480 --> 00:15:50,409
be neutral at some point and so

424
00:15:48,220 --> 00:15:51,820
something had to ionize the gas this is

425
00:15:50,409 --> 00:15:54,069
this process is what we called Reionization

426
00:15:51,820 --> 00:15:55,330
ization and people have been debating

427
00:15:54,070 --> 00:15:57,280
back and forth for a long time about

428

00:15:55,330 --> 00:15:59,280
what there was galaxies that produce the

429
00:15:57,279 --> 00:16:01,299
photons to do this or perhaps

430
00:15:59,279 --> 00:16:02,860
supermassive black holes that are

431
00:16:01,299 --> 00:16:04,659
creating lots of material and being

432
00:16:02,860 --> 00:16:06,399
entered very energetic and the earth

433
00:16:04,659 --> 00:16:08,559
we're still talking early universe right

434
00:16:06,399 --> 00:16:11,289
yeah so they were black holes around

435
00:16:08,559 --> 00:16:13,149
even at this stage well was so there's

436
00:16:11,289 --> 00:16:14,500
one at red chip seven we found one over

437
00:16:13,149 --> 00:16:16,569
age of seven and we found several rich

438
00:16:14,500 --> 00:16:18,009
of six but the current so the current

439
00:16:16,570 --> 00:16:20,860
thinking is that there are not enough

440
00:16:18,009 --> 00:16:22,990
black holes and so it must be galaxies

441
00:16:20,860 --> 00:16:24,940
and so the other way to answer that

442
00:16:22,990 --> 00:16:26,919

question is count up the galaxies and

443

00:16:24,940 --> 00:16:29,380

see if there are enough and this was one

444

00:16:26,919 --> 00:16:30,969

of the main goals of candles it's also a

445

00:16:29,379 --> 00:16:33,159

main goal of Pablo frontier fields is

446

00:16:30,970 --> 00:16:36,129

counting up all the galaxies you can see

447

00:16:33,159 --> 00:16:38,259

and are they producing enough photons to

448

00:16:36,129 --> 00:16:41,200

actually do this realization and the

449

00:16:38,259 --> 00:16:43,389

answer is actually no real it but if we

450

00:16:41,200 --> 00:16:45,430

extrapolate from what we see so we

451

00:16:43,389 --> 00:16:47,409

measure the distribution of luminosities

452

00:16:45,429 --> 00:16:49,449

and then we just start it's basically a

453

00:16:47,409 --> 00:16:51,879

histogram of galaxies brightnesses and

454

00:16:49,450 --> 00:16:53,110

it just cuts gets cut off at some point

455

00:16:51,879 --> 00:16:55,210

because Hubble can't see that deep but

456

00:16:53,110 --> 00:16:57,370

if we extrapolate that further down to

457
00:16:55,210 --> 00:16:59,769
where we think galaxies may exist what

458
00:16:57,370 --> 00:17:00,909
simulations tell us it is enough but we

459
00:16:59,769 --> 00:17:03,039
would like to observe them because

460
00:17:00,909 --> 00:17:04,930
simulations have been wrong before right

461
00:17:03,039 --> 00:17:07,449
it's just a prediction so that's what

462
00:17:04,930 --> 00:17:09,910
ketron has been has been doing so you

463
00:17:07,449 --> 00:17:12,068
really want to see them not just infer

464
00:17:09,910 --> 00:17:13,660
that they're there we really want to see

465
00:17:12,068 --> 00:17:15,549
him and so we're seeing some of them

466
00:17:13,660 --> 00:17:17,769
with the frontier fields will see even

467
00:17:15,549 --> 00:17:22,269
more with jwst will see even more with a

468
00:17:17,769 --> 00:17:23,828
jwst frontier fields program ooh even

469
00:17:22,269 --> 00:17:26,230
more unless you guys ever talk about the

470
00:17:23,828 --> 00:17:29,349
the high-definition Space Telescope if

471
00:17:26,230 --> 00:17:30,759
you had a we're not where we're going

472
00:17:29,349 --> 00:17:32,379
we're doing we're going to be doing that

473
00:17:30,759 --> 00:17:34,359
a lot more as time goes on we had we've

474
00:17:32,380 --> 00:17:38,860
had one hang out on that already yeah in

475
00:17:34,359 --> 00:17:40,809
in in other forum but so yeah so I want

476
00:17:38,859 --> 00:17:42,939
to I wanted this this idea of rihanna's

477
00:17:40,809 --> 00:17:45,549
ation is a very very interesting one to

478
00:17:42,940 --> 00:17:48,100
be but it but to sign i'm going to

479
00:17:45,549 --> 00:17:49,389
oversimplify it but it is a stage in the

480
00:17:48,099 --> 00:17:55,149
history of the universe

481
00:17:49,390 --> 00:17:57,400
we're at hydrogen atoms that were once

482
00:17:55,150 --> 00:17:59,440
had all of their uh it would basically

483
00:17:57,400 --> 00:18:01,450
permeated about the most of the dominant

484
00:17:59,440 --> 00:18:04,360
matter in the universe lost that

485

00:18:01,450 --> 00:18:06,340
electron do some mechanism you're saying

486
00:18:04,359 --> 00:18:07,809
that it could be black holes but there

487
00:18:06,339 --> 00:18:09,429
probably wasn't enough and it might be

488
00:18:07,809 --> 00:18:15,309
the galaxies but now you're saying

489
00:18:09,430 --> 00:18:17,410
probably not that either um well I right

490
00:18:15,309 --> 00:18:19,960
we just yeah well so what you would

491
00:18:17,410 --> 00:18:21,910
probably give the galaxies well if we

492
00:18:19,960 --> 00:18:24,490
can't see the galaxies that are doing it

493
00:18:21,910 --> 00:18:26,200
I see so I'm a limitation Hubble yeah so

494
00:18:24,490 --> 00:18:28,450
they're way more galaxies we can't see

495
00:18:26,200 --> 00:18:29,860
them we can't see oh yeah that being

496
00:18:28,450 --> 00:18:31,660
said there was actually another recent

497
00:18:29,859 --> 00:18:33,609
papers that came out of candles

498
00:18:31,660 --> 00:18:36,519
combining candles with Chandra x-ray

499
00:18:33,609 --> 00:18:38,289

data to show that perhaps there are a

500

00:18:36,519 --> 00:18:40,269

lot more plays are as a higher redshift

501

00:18:38,289 --> 00:18:43,180

than we think and maybe quasars could do

502

00:18:40,269 --> 00:18:45,279

it all okay so that's very recent that

503

00:18:43,180 --> 00:18:46,900

that paper came out quasars in the early

504

00:18:45,279 --> 00:18:48,369

universe so we're and what's the rough

505

00:18:46,900 --> 00:18:50,830

and so is the time periods Rihanna

506

00:18:48,369 --> 00:18:53,439

zation like what the history of this

507

00:18:50,829 --> 00:18:54,490

particular research paper around 500

508

00:18:53,440 --> 00:18:56,080

million years after the Big Bang is that

509

00:18:54,490 --> 00:18:58,359

the kind of time scale we're talking

510

00:18:56,079 --> 00:18:59,799

about here yeah so as probably we don't

511

00:18:58,359 --> 00:19:01,959

know but it was probably a process that

512

00:18:59,799 --> 00:19:03,849

took a few hundred million years and so

513

00:19:01,960 --> 00:19:06,069

our best constraints our Rionda station

514
00:19:03,849 --> 00:19:08,919
started you know maybe between redshift

515
00:19:06,069 --> 00:19:11,259
10 and 12 and ended at wretches 6 ok so

516
00:19:08,920 --> 00:19:13,870
there's there is this need then to count

517
00:19:11,259 --> 00:19:15,369
as many as we can of the galaxies that

518
00:19:13,869 --> 00:19:17,769
existed in this period of the universe

519
00:19:15,369 --> 00:19:20,259
the universe's history to determine if

520
00:19:17,769 --> 00:19:22,059
they were responsible for could have the

521
00:19:20,259 --> 00:19:23,309
energy enough to throw away all but not

522
00:19:22,059 --> 00:19:25,869
throw away with strip away these

523
00:19:23,309 --> 00:19:28,509
electrons from the early hydrogen atoms

524
00:19:25,869 --> 00:19:30,519
and this sounds like that and you're

525
00:19:28,509 --> 00:19:33,009
using Hubble to do it with candles among

526
00:19:30,519 --> 00:19:34,779
other things I wanted to talk to Karen

527
00:19:33,009 --> 00:19:36,940
about the method that he used with it

528
00:19:34,779 --> 00:19:39,460
but he hasn't returned yet is that

529
00:19:36,940 --> 00:19:42,100
something you can comment I can't really

530
00:19:39,460 --> 00:19:44,980
comment on on it I he will do a much

531
00:19:42,099 --> 00:19:48,039
better job than I will so it's plug in

532
00:19:44,980 --> 00:19:51,220
as Ethernet cable as we speak oh yeah so

533
00:19:48,039 --> 00:19:52,839
uh what he's trying to do I know you

534
00:19:51,220 --> 00:19:55,089
guys had that graphic you popped up a

535
00:19:52,839 --> 00:19:58,419
little bit ago those blue and red images

536
00:19:55,089 --> 00:20:01,209
so if you take you know all the galaxies

537
00:19:58,420 --> 00:20:03,100
that are below the Hubble detection that

538
00:20:01,210 --> 00:20:05,019
we can't resolve them we can't see them

539
00:20:03,099 --> 00:20:06,459
is actually still getting light from

540
00:20:05,019 --> 00:20:08,769
those galaxies there's just a lot of

541
00:20:06,460 --> 00:20:10,720
noise in there but those galaxies are

542

00:20:08,769 --> 00:20:13,058
distributed about the universe not in a

543
00:20:10,720 --> 00:20:14,500
random way but in a clustered way galaxy

544
00:20:13,058 --> 00:20:16,990
is like to live where other galaxies

545
00:20:14,500 --> 00:20:19,329
like to live galaxies cluster and so if

546
00:20:16,990 --> 00:20:21,609
you try to statistically look at the

547
00:20:19,329 --> 00:20:25,210
background and see if there's any kind

548
00:20:21,609 --> 00:20:27,129
of preferential clustering of the

549
00:20:25,210 --> 00:20:28,960
fluctuations of the background light in

550
00:20:27,130 --> 00:20:30,820
the image you may be able to get a

551
00:20:28,960 --> 00:20:32,380
handle on what's left so they take

552
00:20:30,819 --> 00:20:34,808
something like the candles image and

553
00:20:32,380 --> 00:20:37,539
remove all of the actual galaxies that

554
00:20:34,808 --> 00:20:41,168
we can see and try and see what's left

555
00:20:37,538 --> 00:20:43,869
essentially okay so what are we looking

556
00:20:41,169 --> 00:20:45,788

at here we've got three panels yeah and

557

00:20:43,869 --> 00:20:48,879

so so we should a sketch run again when

558

00:20:45,788 --> 00:20:51,308

he gets online Oh left one is the actual

559

00:20:48,880 --> 00:20:53,830

candles image and then the two right

560

00:20:51,308 --> 00:20:55,480

panels are two components of what is

561

00:20:53,829 --> 00:20:56,769

left after you take out the galaxy so

562

00:20:55,480 --> 00:20:59,558

all those little white dots in the left

563

00:20:56,769 --> 00:21:00,788

image you you can remove them or you or

564

00:20:59,558 --> 00:21:02,440

you the very least you mash them out

565

00:21:00,788 --> 00:21:04,210

that's actually what the holes are in

566

00:21:02,440 --> 00:21:05,980

the middle and the right panel right

567

00:21:04,210 --> 00:21:07,808

some of those dark holes correspond to

568

00:21:05,980 --> 00:21:09,159

some of the big sources so you just

569

00:21:07,808 --> 00:21:10,538

match those al you say I don't have any

570

00:21:09,159 --> 00:21:12,159

information here it's all blocked out by

571
00:21:10,538 --> 00:21:14,740
in your bike out and then you really

572
00:21:12,159 --> 00:21:16,929
just pump up what's left yeah and so it

573
00:21:14,740 --> 00:21:19,000
turns out there are two components the

574
00:21:16,929 --> 00:21:20,200
middle component was discovered at least

575
00:21:19,000 --> 00:21:22,210
to my knowledge at least robustly

576
00:21:20,200 --> 00:21:24,069
discovered last year where it was found

577
00:21:22,210 --> 00:21:26,169
that some of this background fluctuation

578
00:21:24,069 --> 00:21:28,359
is actually due to essentially homeless

579
00:21:26,169 --> 00:21:29,650
stars so stars that have been stripped

580
00:21:28,359 --> 00:21:31,750
out of their galaxies due to

581
00:21:29,650 --> 00:21:33,159
gravitational encounters this kind of

582
00:21:31,750 --> 00:21:35,798
free-floating stars out there in the

583
00:21:33,159 --> 00:21:37,480
universe ah but what keira was able to

584
00:21:35,798 --> 00:21:39,429
do with candles with unique wavelength

585
00:21:37,480 --> 00:21:40,990
range and depth probe by candles will

586
00:21:39,429 --> 00:21:43,240
show that there was a second component

587
00:21:40,990 --> 00:21:47,099
from galaxies that had to be coming from

588
00:21:43,240 --> 00:21:50,048
the very early universe okay so nothing

589
00:21:47,099 --> 00:21:53,678
just to put a little bit of context here

590
00:21:50,048 --> 00:21:56,558
this leftmost panel is a extremely teeny

591
00:21:53,679 --> 00:21:58,480
tiny little square of the sky we're

592
00:21:56,558 --> 00:22:00,788
talking about a very tiny amount here

593
00:21:58,480 --> 00:22:02,860
odd good he looks like he's back yeah

594
00:22:00,788 --> 00:22:04,839
sorry about that and that's quite all

595
00:22:02,859 --> 00:22:06,099
right you very much better now I've got

596
00:22:04,839 --> 00:22:07,298
some more questions for you and we're

597
00:22:06,099 --> 00:22:09,490
just kind of explaining what's going on

598
00:22:07,298 --> 00:22:11,259
so this was what we're looking at in

599

00:22:09,490 --> 00:22:12,970
this panel and and steve was given us a

600
00:22:11,259 --> 00:22:15,400
little bit of background on what we're

601
00:22:12,970 --> 00:22:16,960
looking at but I was just trying to get

602
00:22:15,400 --> 00:22:18,610
some context with this when it says

603
00:22:16,960 --> 00:22:20,528
I we're looking at a real teeny tiny

604
00:22:18,609 --> 00:22:22,240
portion of the sky so why don't you

605
00:22:20,528 --> 00:22:25,960
describe for us where I'd like to learn

606
00:22:22,240 --> 00:22:27,579
a little bit about what you did to to

607
00:22:25,960 --> 00:22:29,590
sort of do this statistical analysis

608
00:22:27,579 --> 00:22:31,240
with this data and and steve has already

609
00:22:29,589 --> 00:22:33,699
said that you've taken the stars here

610
00:22:31,240 --> 00:22:35,109
and the ones that have been when you

611
00:22:33,700 --> 00:22:37,600
call them tightly striptease or stars

612
00:22:35,109 --> 00:22:40,209
they that are meant to be ripped away

613
00:22:37,599 --> 00:22:41,408

from their host galaxies well what we're

614

00:22:40,210 --> 00:22:44,740
left with is what's in them in the

615

00:22:41,409 --> 00:22:46,690
center the center panel and ran and then

616

00:22:44,740 --> 00:22:49,329
you did something I missed it about to

617

00:22:46,690 --> 00:22:51,730
get us to the to the right panel yeah so

618

00:22:49,329 --> 00:22:53,668
actually both of those the second and

619

00:22:51,730 --> 00:22:57,669
third panels were both reconstructions

620

00:22:53,669 --> 00:23:01,000
actually of model fits that we did so

621

00:22:57,669 --> 00:23:02,740
after I made mosaics in oh it is where

622

00:23:01,000 --> 00:23:04,919
you apply to model to what the

623

00:23:02,740 --> 00:23:08,140
background of this of the leftmost image

624

00:23:04,919 --> 00:23:11,230
that's right yeah so well a masked

625

00:23:08,140 --> 00:23:16,179
version of that sky so after we removed

626

00:23:11,230 --> 00:23:19,240
all the point sources we we isolated the

627

00:23:16,179 --> 00:23:21,190
background light and the statistics

628
00:23:19,240 --> 00:23:23,950
comes in because we do what's called the

629
00:23:21,190 --> 00:23:27,278
angular power spectrum it's very similar

630
00:23:23,950 --> 00:23:28,659
to what they did for the CMB uh that's a

631
00:23:27,278 --> 00:23:31,960
that's a Fourier transform technique

632
00:23:28,659 --> 00:23:34,390
right yeah exactly yeah yeah so on on

633
00:23:31,960 --> 00:23:36,159
small areas it's a Fourier transform on

634
00:23:34,390 --> 00:23:38,409
larger areas it's just a decomposition

635
00:23:36,159 --> 00:23:41,528
of the sky into the spherical harmonics

636
00:23:38,409 --> 00:23:43,330
yeah okay so and so with this is what

637
00:23:41,528 --> 00:23:44,558
this is a technique folks where if you

638
00:23:43,329 --> 00:23:45,970
have something that looks like a lot of

639
00:23:44,558 --> 00:23:48,148
noise if there's any pattern in there

640
00:23:45,970 --> 00:23:52,298
it'll come out in one of those kinds of

641
00:23:48,148 --> 00:23:55,778
transforms so so you did that we did

642
00:23:52,298 --> 00:23:57,429
that and then we have a power spectrum

643
00:23:55,778 --> 00:24:01,240
measurement for all these different

644
00:23:57,429 --> 00:24:03,659
bands and then a Santa and his postdoc

645
00:24:01,240 --> 00:24:06,659
applies these relatively complicated

646
00:24:03,659 --> 00:24:11,380
theoretical models and they fit the data

647
00:24:06,659 --> 00:24:16,028
with their models because so once once

648
00:24:11,380 --> 00:24:17,710
they fit the data they give me basically

649
00:24:16,028 --> 00:24:20,079
the model parameters and then what I do

650
00:24:17,710 --> 00:24:23,950
is I invert the power spectra from those

651
00:24:20,079 --> 00:24:26,859
models back to real space and you can

652
00:24:23,950 --> 00:24:30,160
see in the second and third figures what

653
00:24:26,859 --> 00:24:32,409
oh and then you count up ok oh

654
00:24:30,160 --> 00:24:33,850
get it now all right so you start with

655
00:24:32,410 --> 00:24:35,680
the background image of the sky and

656

00:24:33,849 --> 00:24:37,509
candles we get rid of the stars you do a

657
00:24:35,680 --> 00:24:40,450
Fourier transform of or power get a

658
00:24:37,509 --> 00:24:42,339
power spectrum of it you apply a model

659
00:24:40,450 --> 00:24:45,190
which says look if your power spectrum

660
00:24:42,339 --> 00:24:47,139
looks like this then you have this many

661
00:24:45,190 --> 00:24:49,690
galaxies in and your Galaxy model will

662
00:24:47,140 --> 00:24:51,460
look like what I say and then you took

663
00:24:49,690 --> 00:24:52,990
that model and said okay good well this

664
00:24:51,460 --> 00:24:55,000
is what we have the power spectrum does

665
00:24:52,990 --> 00:24:57,700
look like this model let me invert it

666
00:24:55,000 --> 00:24:59,140
back into space and i will show you and

667
00:24:57,700 --> 00:25:01,240
there's the end of the galaxies and then

668
00:24:59,140 --> 00:25:05,920
you count them all up that's right yeah

669
00:25:01,240 --> 00:25:09,009
okay so um and I whole process took two

670
00:25:05,920 --> 00:25:10,690

years and that whole thing but that's

671

00:25:09,009 --> 00:25:12,940
still really cool i mean i like that

672

00:25:10,690 --> 00:25:15,340
that's what so that is how and now okay

673

00:25:12,940 --> 00:25:16,809
so this is stuff that's down in the

674

00:25:15,339 --> 00:25:18,250
noise of an image when you talk about a

675

00:25:16,809 --> 00:25:19,779
background of an image this is stuff

676

00:25:18,250 --> 00:25:22,480
where everything is like you don't know

677

00:25:19,779 --> 00:25:24,490
if you're looking at noise with from the

678

00:25:22,480 --> 00:25:26,950
sky or from the instrument or from

679

00:25:24,490 --> 00:25:29,380
Hubble or from whatever or if you're

680

00:25:26,950 --> 00:25:31,509
looking at actual signal is did you get

681

00:25:29,380 --> 00:25:34,540
that from the Fourier transform is that

682

00:25:31,509 --> 00:25:38,200
yeah well we're looking at correlation

683

00:25:34,539 --> 00:25:39,879
so a lot of the noise is uncorrelated so

684

00:25:38,200 --> 00:25:41,049
what I did is I made well you got to

685
00:25:39,880 --> 00:25:43,570
describe what you mean by that what I

686
00:25:41,049 --> 00:25:48,309
mean the noise is uncorrelated with what

687
00:25:43,569 --> 00:25:49,629
uh with itself so noise is not

688
00:25:48,309 --> 00:25:54,429
correlated with itself that's a

689
00:25:49,630 --> 00:25:57,970
definition no matter so so what I did is

690
00:25:54,430 --> 00:26:01,360
I made uh two different images of the

691
00:25:57,970 --> 00:26:03,339
same area of sky for each filter so what

692
00:26:01,359 --> 00:26:05,109
I would do is I would take one image

693
00:26:03,339 --> 00:26:07,059
that has the exact same sky as the other

694
00:26:05,109 --> 00:26:09,939
like to the pixel they're aligned but

695
00:26:07,059 --> 00:26:11,169
but different filters sit same filter or

696
00:26:09,940 --> 00:26:12,730
a different filter but let's let's just

697
00:26:11,170 --> 00:26:14,380
talk about the auto power spectra so for

698
00:26:12,730 --> 00:26:19,170
the same filter I would make two maps

699
00:26:14,380 --> 00:26:22,510
and if I if I took the power spectrum of

700
00:26:19,170 --> 00:26:25,000
those two maps together then what would

701
00:26:22,509 --> 00:26:28,299
happen is that the the uncorrelated

702
00:26:25,000 --> 00:26:31,809
noise would drop out of it okay that

703
00:26:28,299 --> 00:26:34,000
makes sense yes I think well enough in a

704
00:26:31,809 --> 00:26:35,440
sense enough I think so okay so you were

705
00:26:34,000 --> 00:26:37,240
able to and that gives you you obviously

706
00:26:35,440 --> 00:26:39,309
have some confidence level then in what

707
00:26:37,240 --> 00:26:41,319
you're what you've got here yeah sure so

708
00:26:39,309 --> 00:26:43,849
so to get them basically the noise power

709
00:26:41,319 --> 00:26:46,220
spectrum is i would subtract those two

710
00:26:43,849 --> 00:26:47,269
maps from each other and that in

711
00:26:46,220 --> 00:26:49,490
principle would take out the

712
00:26:47,269 --> 00:26:51,798
astrophysical signal and then I would

713

00:26:49,490 --> 00:26:54,829
take the power spectrum of that and I

714
00:26:51,798 --> 00:26:56,538
with the galaxies and that way mom yeah

715
00:26:54,829 --> 00:26:59,509
well that would be our error bars part

716
00:26:56,538 --> 00:27:02,089
of our Arab oh okay good awesome well

717
00:26:59,509 --> 00:27:03,919
good all right so uh in a minute I'm

718
00:27:02,089 --> 00:27:05,329
going to get to what your answer was and

719
00:27:03,919 --> 00:27:08,059
what you found after doing all of that

720
00:27:05,329 --> 00:27:09,439
but woot vanderheide is asking and then

721
00:27:08,058 --> 00:27:12,558
it's got a few wouldn't mind I had asked

722
00:27:09,440 --> 00:27:13,970
you to grab a diagram for me that sort

723
00:27:12,558 --> 00:27:15,829
of shows the oakley you've got something

724
00:27:13,970 --> 00:27:17,210
else up what he got up so what did it no

725
00:27:15,829 --> 00:27:18,619
no well we'll come right back to that

726
00:27:17,210 --> 00:27:22,130
but if I could get you to put up that

727
00:27:18,619 --> 00:27:23,750

map for me or that diagram for me he is

728

00:27:22,130 --> 00:27:25,280

asking and I want to go back to the side

729

00:27:23,750 --> 00:27:28,009

this period of rihanna's ation because

730

00:27:25,279 --> 00:27:30,710

it's important he's asking when and how

731

00:27:28,009 --> 00:27:33,109

did Rihanna zation occur now let this

732

00:27:30,710 --> 00:27:34,970

diagram kind of shows a history of the

733

00:27:33,109 --> 00:27:38,689

universe this is one of my favorite kind

734

00:27:34,970 --> 00:27:40,610

of descriptions of the way in which

735

00:27:38,690 --> 00:27:43,009

things happened in the universe so Steve

736

00:27:40,609 --> 00:27:46,209

can you give us some sense of where in

737

00:27:43,009 --> 00:27:49,700

this thing the rihanna's ation would lie

738

00:27:46,210 --> 00:27:52,130

I think I'm reading it right now it

739

00:27:49,700 --> 00:27:54,259

looks like the second slice from the

740

00:27:52,130 --> 00:27:58,429

right the kind of purple one we're sort

741

00:27:54,259 --> 00:27:59,569

of the first galaxies are forming so so

742
00:27:58,429 --> 00:28:01,640
this point where says structure

743
00:27:59,569 --> 00:28:04,759
formation that's what we're talking

744
00:28:01,640 --> 00:28:06,080
about here and and so we're looking you

745
00:28:04,759 --> 00:28:08,929
know this is what about a billion years

746
00:28:06,079 --> 00:28:10,519
or so after the Big Bang and the way if

747
00:28:08,929 --> 00:28:11,929
you go backward you see all kinds of

748
00:28:10,519 --> 00:28:13,519
very strange things happening not the

749
00:28:11,929 --> 00:28:15,200
least of which is inflation but that's

750
00:28:13,519 --> 00:28:17,869
all outside of the order of this thing

751
00:28:15,200 --> 00:28:19,009
but this is when we're talking about in

752
00:28:17,869 --> 00:28:20,808
the history of the universe so about a

753
00:28:19,009 --> 00:28:23,900
billion a little bit before that years

754
00:28:20,808 --> 00:28:25,460
after the Big Bang as far as how Rihanna

755
00:28:23,900 --> 00:28:27,169
Rihanna zation occurred that's what

756
00:28:25,460 --> 00:28:30,079
we're trying to figure out now right

757
00:28:27,169 --> 00:28:32,720
guys that's right so as well as Steve

758
00:28:30,079 --> 00:28:34,879
was saying it thought that it could be

759
00:28:32,720 --> 00:28:35,839
due to black holes well it could be

760
00:28:34,880 --> 00:28:37,669
doing this but then there probably

761
00:28:35,839 --> 00:28:39,230
wasn't enough this early on in the

762
00:28:37,669 --> 00:28:40,549
universe's history and now they're

763
00:28:39,230 --> 00:28:43,279
trying to determine if there are enough

764
00:28:40,548 --> 00:28:46,129
galaxies in the early universe to have

765
00:28:43,279 --> 00:28:48,288
had the energy to do this and and what

766
00:28:46,130 --> 00:28:50,720
Catron's been doing is try to figure out

767
00:28:48,288 --> 00:28:54,650
using these Fourier analysis techniques

768
00:28:50,720 --> 00:28:56,360
and modeling how many that were so

769
00:28:54,650 --> 00:28:57,650
you've got your error bars catcher and

770

00:28:56,359 --> 00:28:59,569
you've got you if you figured out

771
00:28:57,650 --> 00:29:02,450
out you party got a pretty good idea of

772
00:28:59,569 --> 00:29:05,539
your little slice of sky there how many

773
00:29:02,450 --> 00:29:08,360
galaxies did you find well what's the so

774
00:29:05,539 --> 00:29:11,450
what'd you find out how many are there

775
00:29:08,359 --> 00:29:14,419
enough galaxies do you think to do this

776
00:29:11,450 --> 00:29:19,850
kind of reorganization and how many are

777
00:29:14,420 --> 00:29:23,600
there i yes there are enough we found

778
00:29:19,849 --> 00:29:26,659
that there are an order of ten times as

779
00:29:23,599 --> 00:29:28,339
many as we previously thought ten times

780
00:29:26,660 --> 00:29:34,820
more galaxies in what everybody thought

781
00:29:28,339 --> 00:29:38,209
before yeah so a typical deep survey for

782
00:29:34,819 --> 00:29:40,849
Hubble usually takes really long

783
00:29:38,210 --> 00:29:42,559
integrations over a smaller area and

784
00:29:40,849 --> 00:29:44,539

what they pick up is really the

785

00:29:42,559 --> 00:29:47,779

brightest sources at these really old

786

00:29:44,539 --> 00:29:50,720

epochs but what we're doing is picking

787

00:29:47,779 --> 00:29:53,299

up a signal from kind of the more

788

00:29:50,720 --> 00:29:56,480

character characteristic population okay

789

00:29:53,299 --> 00:30:01,970

that's not as bright so is what Scott

790

00:29:56,480 --> 00:30:03,410

showing now uh describing that what is

791

00:30:01,970 --> 00:30:07,579

this showing actually I don't get it

792

00:30:03,410 --> 00:30:10,690

yeah so the this is a the brightness of

793

00:30:07,579 --> 00:30:14,240

the background light as a function of

794

00:30:10,690 --> 00:30:16,130

wavelength so this wave links at the

795

00:30:14,240 --> 00:30:18,940

bottom and brightest okay yeah that's

796

00:30:16,130 --> 00:30:21,290

right so the star-formation rate is is

797

00:30:18,940 --> 00:30:24,650

directly proportional to the amplitude

798

00:30:21,289 --> 00:30:28,129

of our power spectra and that's shown

799

00:30:24,650 --> 00:30:30,920
with those yellow points so the two

800

00:30:28,130 --> 00:30:32,420
right word yellow yellow points are the

801

00:30:30,920 --> 00:30:33,620
whip see three bands and those are the

802

00:30:32,420 --> 00:30:37,250
two bands where we're picking up this

803

00:30:33,619 --> 00:30:38,479
very important yeah yeah and then you go

804

00:30:37,250 --> 00:30:41,509
to the shorter bands and the signal just

805

00:30:38,480 --> 00:30:43,759
totally drops out and that doesn't

806

00:30:41,509 --> 00:30:45,920
contain any high redshift component in

807

00:30:43,759 --> 00:30:49,430
it so based on the amplitude of that

808

00:30:45,920 --> 00:30:52,120
brightness we can kind of deduce the

809

00:30:49,430 --> 00:30:55,400
amount of star formation that's going on

810

00:30:52,119 --> 00:30:57,199
which tells you then how many galaxies

811

00:30:55,400 --> 00:30:58,310
there are yeah that's right I'm trying

812

00:30:57,200 --> 00:30:59,840
to get to the connection between the

813
00:30:58,309 --> 00:31:02,029
galaxies what's that red line there that

814
00:30:59,839 --> 00:31:03,559
just peeks at the near-infrared what

815
00:31:02,029 --> 00:31:04,879
what's the wave I can't see because

816
00:31:03,559 --> 00:31:08,089
everybody's thumbnails what's the

817
00:31:04,880 --> 00:31:10,520
wavelength um that's right around one

818
00:31:08,089 --> 00:31:11,308
micron all those are microns okay one

819
00:31:10,519 --> 00:31:13,558
right

820
00:31:11,308 --> 00:31:15,269
have one Mike okay good so it Peaks

821
00:31:13,558 --> 00:31:17,069
right around mount one micron and so

822
00:31:15,269 --> 00:31:19,190
this is where candles was giving you a

823
00:31:17,069 --> 00:31:21,808
lot of data you said you also used uh

824
00:31:19,190 --> 00:31:25,230
archived data for this as well yeah I

825
00:31:21,808 --> 00:31:28,048
did so Steve mentioned a good survey so

826
00:31:25,230 --> 00:31:31,259
this does not be before candles yeah

827

00:31:28,048 --> 00:31:34,288
that's right i think in 2004 gia Velasco

828
00:31:31,259 --> 00:31:37,589
had a lot of observations in the

829
00:31:34,288 --> 00:31:41,519
advanced camera for surveys the ACS it's

830
00:31:37,589 --> 00:31:45,509
been on Hubble so what actually happened

831
00:31:41,519 --> 00:31:47,849
I think on the fourth servicing mission

832
00:31:45,509 --> 00:31:51,960
of Hubble they replaced so the readout

833
00:31:47,849 --> 00:31:54,449
box for acs and that introduced some

834
00:31:51,960 --> 00:31:56,269
correlated noise into the instrument so

835
00:31:54,450 --> 00:31:59,730
we actually couldn't use that much

836
00:31:56,269 --> 00:32:04,700
candles data from acs because of that so

837
00:31:59,730 --> 00:32:07,769
we had to use archive data and we used

838
00:32:04,700 --> 00:32:12,179
the majority of the ACS data is from the

839
00:32:07,769 --> 00:32:15,028
archive from between 2001 and 2011 I

840
00:32:12,179 --> 00:32:16,919
think okay all right so you found 10

841
00:32:15,028 --> 00:32:18,659

times more galaxies and we're previously

842

00:32:16,919 --> 00:32:20,038

thought in this period of the universe

843

00:32:18,659 --> 00:32:25,799

you think there's more than enough now

844

00:32:20,038 --> 00:32:27,240

to come to uh to understand the i don't

845

00:32:25,798 --> 00:32:29,128

know if i should say the engine of

846

00:32:27,240 --> 00:32:30,298

rihanna's ation or not but something

847

00:32:29,128 --> 00:32:34,138

that at least there's an X there's a

848

00:32:30,298 --> 00:32:36,628

driver behind some of it at least what

849

00:32:34,138 --> 00:32:39,628

it can you would it be helpful to go

850

00:32:36,628 --> 00:32:42,449

back any further than this particular

851

00:32:39,628 --> 00:32:43,949

period that candles was looking at or is

852

00:32:42,450 --> 00:32:47,490

this pretty much as far back you need to

853

00:32:43,950 --> 00:32:49,740

go Colin I mean yeah cosmological ear in

854

00:32:47,490 --> 00:32:51,808

the universe is this about as it would

855

00:32:49,740 --> 00:32:56,940

help to go any further back well if we

856
00:32:51,808 --> 00:33:02,038
could we would and why can't you well

857
00:32:56,940 --> 00:33:03,298
said was right right so what vui you see

858
00:33:02,038 --> 00:33:05,519
Rob go over this you've pretty much

859
00:33:03,298 --> 00:33:08,490
reached a limit of where Hubble can

860
00:33:05,519 --> 00:33:10,859
lease in terms of candles can do Carolyn

861
00:33:08,490 --> 00:33:13,558
gasps planning for their TARDIS yet they

862
00:33:10,859 --> 00:33:14,969
are waiting and exactly so I mean I

863
00:33:13,558 --> 00:33:16,470
don't Carol I don't know if you know

864
00:33:14,970 --> 00:33:18,149
this or not but is it possible to do

865
00:33:16,470 --> 00:33:19,950
anything more with this do you think

866
00:33:18,148 --> 00:33:21,449
with the frontier fields because

867
00:33:19,950 --> 00:33:23,519
frontier fields is cheating a little bit

868
00:33:21,450 --> 00:33:25,170
frontier fields is using lenses galaxy

869
00:33:23,519 --> 00:33:27,450
lenses to kind of boost the power

870
00:33:25,170 --> 00:33:30,600
bubble is there a chance you think maybe

871
00:33:27,450 --> 00:33:32,610
biting you mean science Aang yeah no I

872
00:33:30,599 --> 00:33:35,549
think our guests are better suited to

873
00:33:32,609 --> 00:33:40,529
answer the thing is that yeah it looks

874
00:33:35,549 --> 00:33:42,569
back um part of the thing I mean for me

875
00:33:40,529 --> 00:33:46,289
thinking about the frontier fields data

876
00:33:42,569 --> 00:33:48,359
you've got this lensing stuff going on

877
00:33:46,289 --> 00:33:50,460
so talking about how you're going to

878
00:33:48,359 --> 00:33:51,959
handle the instrumentation and how

879
00:33:50,460 --> 00:33:54,930
you're going to subtract out the lens

880
00:33:51,960 --> 00:33:59,220
galaxies and the behind galaxies and see

881
00:33:54,930 --> 00:34:01,320
what noise you have left um I would

882
00:33:59,220 --> 00:34:03,240
think it would be possible but you

883
00:34:01,319 --> 00:34:05,879
should I what do you hope what do you

884

00:34:03,240 --> 00:34:08,309
think lens models to do that what do you

885
00:34:05,880 --> 00:34:10,769
think Catrin are you do you think they

886
00:34:08,309 --> 00:34:13,529
are less shy than I am about that kind

887
00:34:10,769 --> 00:34:15,659
of day does that complicate things

888
00:34:13,530 --> 00:34:17,460
having to undo the lensing models with

889
00:34:15,659 --> 00:34:21,839
with with frontier fields would that

890
00:34:17,460 --> 00:34:23,418
help you at all or no um well I think

891
00:34:21,840 --> 00:34:26,309
that's a fundamentally different

892
00:34:23,418 --> 00:34:28,619
technique than what we're doing here but

893
00:34:26,309 --> 00:34:30,329
it people do do that yeah okay all right

894
00:34:28,619 --> 00:34:32,279
so probably not is basically yet so I

895
00:34:30,329 --> 00:34:33,779
think I think the bigger issue there and

896
00:34:32,280 --> 00:34:35,610
Catrin can correct me if I'm wrong is

897
00:34:33,780 --> 00:34:37,200
that the area that you get for each

898
00:34:35,610 --> 00:34:39,840

frontier fields cluster is much smaller

899

00:34:37,199 --> 00:34:41,639

yeah and one of the candles families and

900

00:34:39,840 --> 00:34:44,220

so you've been basically on you're going

901

00:34:41,639 --> 00:34:45,690

a little deeper but I think it's yeah

902

00:34:44,219 --> 00:34:47,819

it's not really adding that much area

903

00:34:45,690 --> 00:34:49,110

and then you know you have to mask out

904

00:34:47,820 --> 00:34:50,789

everything that's in the image and

905

00:34:49,110 --> 00:34:52,410

there's a lot more galaxies and an image

906

00:34:50,789 --> 00:34:54,418

of a galaxy cluster than in the candles

907

00:34:52,409 --> 00:34:55,949

field and so not only you starting from

908

00:34:54,418 --> 00:34:57,779

a smaller image you then have to mask a

909

00:34:55,949 --> 00:35:00,389

bunch of it out so you're losing a bunch

910

00:34:57,780 --> 00:35:02,640

of space you're losing more pixels okay

911

00:35:00,389 --> 00:35:04,170

so so so candles really was the ideal

912

00:35:02,639 --> 00:35:07,199

data set to help with this with this

913
00:35:04,170 --> 00:35:09,110
kind of research then not so much I

914
00:35:07,199 --> 00:35:12,409
think you kind of need annex

915
00:35:09,110 --> 00:35:15,510
unobstructed view and that's why

916
00:35:12,409 --> 00:35:17,250
telescopes like Jay Davis tea and high

917
00:35:15,510 --> 00:35:18,600
definition of space telescope of

918
00:35:17,250 --> 00:35:21,210
interest because if you want to keep

919
00:35:18,599 --> 00:35:24,360
picking away at this problem down at

920
00:35:21,210 --> 00:35:27,809
this level of noise um you really need

921
00:35:24,360 --> 00:35:31,650
more powerful and bigger telescope and

922
00:35:27,809 --> 00:35:33,239
and more powerful I'm so happy you went

923
00:35:31,650 --> 00:35:36,300
there Carol so let's talk about that

924
00:35:33,239 --> 00:35:38,699
person Katherine can you comment on that

925
00:35:36,300 --> 00:35:42,210
just a little bit i mean the the

926
00:35:38,699 --> 00:35:43,618
so we've done we've done a lot of work

927
00:35:42,210 --> 00:35:45,358
with Hubble about as much as Hubble can

928
00:35:43,619 --> 00:35:47,789
do with this kind of research with

929
00:35:45,358 --> 00:35:49,529
finding these early galaxies in what way

930
00:35:47,789 --> 00:35:51,239
does it help let me ask you this I know

931
00:35:49,530 --> 00:35:53,070
jwst is probably going to be able to

932
00:35:51,239 --> 00:35:55,219
help in this way but what way are you

933
00:35:53,070 --> 00:36:00,300
helping jwst I want to start there first

934
00:35:55,219 --> 00:36:01,379
um directly or indirectly well indirect

935
00:36:00,300 --> 00:36:04,109
I mean aren't you kind of setting the

936
00:36:01,380 --> 00:36:06,960
stage for the signatures and the early

937
00:36:04,108 --> 00:36:09,420
work that if Hubble if you push JWST for

938
00:36:06,960 --> 00:36:12,960
example like you do Hubble and you get

939
00:36:09,420 --> 00:36:15,450
you can help jws team a little bit with

940
00:36:12,960 --> 00:36:19,130
its maybe pushing the boundaries a

941

00:36:15,449 --> 00:36:21,779
little bit am I wrong hopefully oh yeah

942
00:36:19,130 --> 00:36:24,030
maybe they'll be inclined to accept

943
00:36:21,780 --> 00:36:27,030
proposals with this kind of observation

944
00:36:24,030 --> 00:36:28,710
pattern I say ok good so I and of course

945
00:36:27,030 --> 00:36:34,140
then the next question is is jwst gonna

946
00:36:28,710 --> 00:36:35,250
help with this oh absolutely yeah so

947
00:36:34,139 --> 00:36:37,500
there's a chance that they could even

948
00:36:35,250 --> 00:36:39,570
resolve these individual galaxies but

949
00:36:37,500 --> 00:36:42,570
yeah because right now what you're

950
00:36:39,570 --> 00:36:45,539
looking at in noise or in background I

951
00:36:42,570 --> 00:36:47,190
shouldn't call it noise is JW might

952
00:36:45,539 --> 00:36:49,079
actually be able to lose resolve correct

953
00:36:47,190 --> 00:36:52,470
yeah this is so everything I do is

954
00:36:49,079 --> 00:36:53,940
unresolved it's just blobs of over and

955
00:36:52,469 --> 00:36:55,199

under densities right that's an

956

00:36:53,940 --> 00:36:56,909

important point because you're relying

957

00:36:55,199 --> 00:36:59,730

on these power spectra to point out the

958

00:36:56,909 --> 00:37:01,858

features of these things for you and to

959

00:36:59,730 --> 00:37:03,869

identify them in these models to sort of

960

00:37:01,858 --> 00:37:05,759

unravel what you're looking at but here

961

00:37:03,869 --> 00:37:08,220

JW will actually provide observations

962

00:37:05,760 --> 00:37:09,240

correct yeah and the resolution and the

963

00:37:08,219 --> 00:37:13,169

sensitivity is going to be so much

964

00:37:09,239 --> 00:37:15,239

higher that they might even resolve them

965

00:37:13,170 --> 00:37:18,088

individually and then of course after

966

00:37:15,239 --> 00:37:19,588

that we've got even bigger HD st as

967

00:37:18,088 --> 00:37:22,259

Carol pointed out coming out a salute

968

00:37:19,588 --> 00:37:24,210

what about wlb that's what's to you

969

00:37:22,260 --> 00:37:26,099

missed talking about is that it you know

970
00:37:24,210 --> 00:37:28,920
you picking away at this problem and

971
00:37:26,099 --> 00:37:32,068
then you you so I think what's being

972
00:37:28,920 --> 00:37:35,190
said here is that you can infer that

973
00:37:32,068 --> 00:37:36,659
those objects exist but you really want

974
00:37:35,190 --> 00:37:39,000
to see them that's right that's a good

975
00:37:36,659 --> 00:37:40,230
point so right now I'm furring based on

976
00:37:39,000 --> 00:37:42,449
power spectra that they're there and

977
00:37:40,230 --> 00:37:44,280
models that suggested they should be

978
00:37:42,449 --> 00:37:45,539
there but we haven't actually took put

979
00:37:44,280 --> 00:37:47,190
our fingers on them yet and said yes

980
00:37:45,539 --> 00:37:48,900
there's one and that's where the

981
00:37:47,190 --> 00:37:52,079
frontier fields can't help out they are

982
00:37:48,900 --> 00:37:53,249
not going to see them all but we are

983
00:37:52,079 --> 00:37:54,930
we're working on the frontier fields of

984
00:37:53,248 --> 00:37:56,548
my group we're finding a lot of very

985
00:37:54,929 --> 00:37:57,929
very faint galaxies that little good

986
00:37:56,548 --> 00:37:59,818
major that Hubble is able to see before

987
00:37:57,929 --> 00:38:01,469
so maybe we can do another hangout on

988
00:37:59,818 --> 00:38:02,579
that sometime of course you're right dad

989
00:38:01,469 --> 00:38:03,958
paper we haven't done the frontier

990
00:38:02,579 --> 00:38:04,920
fields one in a while so yes I

991
00:38:03,958 --> 00:38:06,058
definitely like to talk a little bit

992
00:38:04,920 --> 00:38:07,459
more about what's going on there so

993
00:38:06,059 --> 00:38:09,749
that's great that's great news okay

994
00:38:07,458 --> 00:38:11,969
first key meant to W first w first would

995
00:38:09,748 --> 00:38:13,768
also be very useful for these types of

996
00:38:11,969 --> 00:38:15,809
analyses because it's because that's not

997
00:38:13,768 --> 00:38:16,919
very wide yields that's right good I'm

998

00:38:15,809 --> 00:38:18,298
glad you do because that's going to be

999
00:38:16,920 --> 00:38:20,039
the reason I wanted to bring it up was

1000
00:38:18,298 --> 00:38:23,130
because that's gonna be before HD st so

1001
00:38:20,039 --> 00:38:24,390
uh so W so W first we'll be able to

1002
00:38:23,130 --> 00:38:25,650
contribute to this quite a bit actually

1003
00:38:24,389 --> 00:38:27,088
I would imagine because it can look at

1004
00:38:25,650 --> 00:38:29,459
you Jerry's at the sky yeah absolutely

1005
00:38:27,088 --> 00:38:31,588
can look at huge areas but it's a it's a

1006
00:38:29,458 --> 00:38:33,748
Hubble size telescope but a single a

1007
00:38:31,588 --> 00:38:36,838
single picture with W first is something

1008
00:38:33,748 --> 00:38:38,788
like a hundred times the area of a

1009
00:38:36,838 --> 00:38:40,679
single picture with Hubble so Katherine

1010
00:38:38,789 --> 00:38:44,009
I know this is a loaded question but the

1011
00:38:40,679 --> 00:38:47,308
the European on track your grad student

1012
00:38:44,009 --> 00:38:50,039

ready to become a PhD are you are you

1013

00:38:47,309 --> 00:38:52,950

excited about using hjw ste and then

1014

00:38:50,039 --> 00:38:57,089

following by a w first and are you going

1015

00:38:52,949 --> 00:38:59,068

to be getting your PhD soon I get a

1016

00:38:57,088 --> 00:39:03,298

terrible question are you getting your

1017

00:38:59,068 --> 00:39:05,278

ph a terrible quail you on track are you

1018

00:39:03,298 --> 00:39:07,079

yeah i actually i think i'll probably

1019

00:39:05,278 --> 00:39:10,079

get him about it next year we're gonna

1020

00:39:07,079 --> 00:39:13,410

view you a few you're not so I mean ever

1021

00:39:10,079 --> 00:39:16,709

for you to phd comics I'm not ask you

1022

00:39:13,409 --> 00:39:18,179

out to me I said it was a loaded

1023

00:39:16,708 --> 00:39:20,448

question I did not mean it in any other

1024

00:39:18,179 --> 00:39:22,348

way other than way I said it so good

1025

00:39:20,449 --> 00:39:24,449

well that's good so that's so good

1026

00:39:22,349 --> 00:39:26,039

because we this you're the generation of

1027
00:39:24,449 --> 00:39:28,170
astronomers I point this out because

1028
00:39:26,039 --> 00:39:31,469
you're the generation of astronomers for

1029
00:39:28,170 --> 00:39:32,880
which jwst is prime suited to help and I

1030
00:39:31,469 --> 00:39:35,190
just wanted to know how what your

1031
00:39:32,880 --> 00:39:38,579
thoughts are on the possibilities of

1032
00:39:35,190 --> 00:39:41,420
using a telescope like that uh yeah i

1033
00:39:38,579 --> 00:39:44,670
mean it it it would be very amazing i

1034
00:39:41,420 --> 00:39:48,358
had the opportunity of it i guess it's a

1035
00:39:44,670 --> 00:39:51,329
few years away 28 year so you've got

1036
00:39:48,358 --> 00:39:54,208
time see you don't worry i get your you

1037
00:39:51,329 --> 00:39:56,759
get your time to finish yeah i'll

1038
00:39:54,208 --> 00:39:58,469
probably finish before that and

1039
00:39:56,759 --> 00:40:00,900
hopefully there are postdoc

1040
00:39:58,469 --> 00:40:03,088
opportunities that would allow such a

1041
00:40:00,900 --> 00:40:05,079
study good alright well that's good to

1042
00:40:03,088 --> 00:40:07,210
know and i wish you best of luck in the

1043
00:40:05,079 --> 00:40:09,429
and in the course of your research I and

1044
00:40:07,210 --> 00:40:11,409
this particular result is I find very

1045
00:40:09,429 --> 00:40:12,849
fascinating one so I want to thank you

1046
00:40:11,409 --> 00:40:15,670
for taking the time out to talk to us

1047
00:40:12,849 --> 00:40:19,779
about this let me look and see if I can

1048
00:40:15,670 --> 00:40:21,849
find any the Q&A app just to co-own a

1049
00:40:19,780 --> 00:40:23,470
Hubble huggers yes good evening Hubble

1050
00:40:21,849 --> 00:40:26,409
huggers or good afternoon depending on

1051
00:40:23,469 --> 00:40:29,739
your your time your time I have I had a

1052
00:40:26,409 --> 00:40:33,969
question and trying to understand the

1053
00:40:29,739 --> 00:40:39,369
way that the data is handled so are

1054
00:40:33,969 --> 00:40:41,859
there are you are you having to deal

1055

00:40:39,369 --> 00:40:44,650
with a lot of calibration and instrument

1056
00:40:41,860 --> 00:40:48,030
effects to make absolutely sure that

1057
00:40:44,650 --> 00:40:53,410
what you are seeing is a real signature

1058
00:40:48,030 --> 00:40:56,170
from an Astrophysical you know density

1059
00:40:53,409 --> 00:40:58,599
of Astrophysical objects I mean it seems

1060
00:40:56,170 --> 00:41:03,210
like when you work around and the noise

1061
00:40:58,599 --> 00:41:06,639
like that it is very difficult yeah

1062
00:41:03,210 --> 00:41:11,889
that's a good question how do you know

1063
00:41:06,639 --> 00:41:14,230
though we do simulations okay I I'll do

1064
00:41:11,889 --> 00:41:17,500
so we have a huge collection of these

1065
00:41:14,230 --> 00:41:19,260
raw individual exposures which make up a

1066
00:41:17,500 --> 00:41:22,570
small subsection of the whole mosaic

1067
00:41:19,260 --> 00:41:25,390
okay so what I'll do is I'll inject some

1068
00:41:22,570 --> 00:41:28,090
signal into these into these individual

1069
00:41:25,389 --> 00:41:31,059

frames a signal that I know very well

1070

00:41:28,090 --> 00:41:33,760

and then I'll mosaic them and then I

1071

00:41:31,059 --> 00:41:36,489

will see how well my mosaicing routine

1072

00:41:33,760 --> 00:41:38,590

is removing offsets and things like this

1073

00:41:36,489 --> 00:41:40,479

and then I'll take that into

1074

00:41:38,590 --> 00:41:43,360

consideration with the final power

1075

00:41:40,480 --> 00:41:45,039

spectra and add the air the total error

1076

00:41:43,360 --> 00:41:48,690

budget is also a function of that of

1077

00:41:45,039 --> 00:41:51,699

those simulations so I spent probably

1078

00:41:48,690 --> 00:41:54,909

4-5 months just running simulations to

1079

00:41:51,699 --> 00:41:59,829

kind of quantify the noise and get a

1080

00:41:54,909 --> 00:42:01,269

hold on the different errors so I mean I

1081

00:41:59,829 --> 00:42:03,039

think this is an important point about

1082

00:42:01,269 --> 00:42:05,289

the way that you know you just don't

1083

00:42:03,039 --> 00:42:07,329

take an observation and voila you have

1084
00:42:05,289 --> 00:42:09,670
this amazing result is that there's

1085
00:42:07,329 --> 00:42:11,469
there's you know getting the data

1086
00:42:09,670 --> 00:42:14,230
calibrating it make sure it's the best

1087
00:42:11,469 --> 00:42:17,319
data you can clean it as best you can

1088
00:42:14,230 --> 00:42:19,030
then you have modeling which is trying

1089
00:42:17,320 --> 00:42:22,150
to look at what the astrophysics under

1090
00:42:19,030 --> 00:42:23,980
I and then and a lot of things you do

1091
00:42:22,150 --> 00:42:26,320
simulations where you put a known thing

1092
00:42:23,980 --> 00:42:28,389
in you see if you can get back out and

1093
00:42:26,320 --> 00:42:30,940
that and that kind of thing i think it's

1094
00:42:28,389 --> 00:42:34,269
it's it's interesting that that shows up

1095
00:42:30,940 --> 00:42:36,599
in many different areas of astrophysics

1096
00:42:34,269 --> 00:42:41,050
and trying to understand the data that

1097
00:42:36,599 --> 00:42:42,130
that comes out yeah and also what I was

1098
00:42:41,050 --> 00:42:45,940
talking about before how I had two

1099
00:42:42,130 --> 00:42:47,349
images for each field for yes so when i

1100
00:42:45,940 --> 00:42:48,940
subtract those two images from each

1101
00:42:47,349 --> 00:42:51,730
other all the astrophysical signal

1102
00:42:48,940 --> 00:42:54,730
should go away and it does yes should

1103
00:42:51,730 --> 00:42:57,760
and it does yeah oh that's good that's

1104
00:42:54,730 --> 00:43:00,250
good that's good but if yet it is a very

1105
00:42:57,760 --> 00:43:04,510
long process from the initial exposure

1106
00:43:00,250 --> 00:43:06,309
to the final results alright gotta got a

1107
00:43:04,510 --> 00:43:08,530
dart go ahead Carroll are you done well I

1108
00:43:06,309 --> 00:43:10,960
had what yeah one other question and

1109
00:43:08,530 --> 00:43:14,080
trying to understand so so if you tried

1110
00:43:10,960 --> 00:43:15,940
to do this with one field it would be a

1111
00:43:14,079 --> 00:43:17,590
little more I would think I don't know

1112

00:43:15,940 --> 00:43:19,480
would be a little more difficult but the

1113
00:43:17,590 --> 00:43:22,780
fact that you have these mosaics and

1114
00:43:19,480 --> 00:43:24,880
that you have several data sets allows

1115
00:43:22,780 --> 00:43:28,390
you to understand the instrument better

1116
00:43:24,880 --> 00:43:29,619
son it seems like the instrument you

1117
00:43:28,389 --> 00:43:31,710
would be able to understand the

1118
00:43:29,619 --> 00:43:34,659
signature of the instrument itself

1119
00:43:31,710 --> 00:43:37,090
pretty well so that you know you're not

1120
00:43:34,659 --> 00:43:39,039
being fooled by some funny effect from

1121
00:43:37,090 --> 00:43:41,289
the instrument right actually met Renee

1122
00:43:39,039 --> 00:43:45,809
CS right that there was a change and

1123
00:43:41,289 --> 00:43:49,690
then it it it was a yeah there's this uh

1124
00:43:45,809 --> 00:43:51,159
Eureka package that a big group of smart

1125
00:43:49,690 --> 00:43:54,070
people at Space Telescope or writing

1126
00:43:51,159 --> 00:43:56,379

wait which I mean it's really amazing

1127
00:43:54,070 --> 00:43:58,240
because they they're basically doing all

1128
00:43:56,380 --> 00:43:59,349
the hard work they're finding all of

1129
00:43:58,239 --> 00:44:00,759
these things that you're talking about

1130
00:43:59,349 --> 00:44:02,710
the instrumental effects and finding

1131
00:44:00,760 --> 00:44:04,810
ways to kind of ameliorate all of the

1132
00:44:02,710 --> 00:44:06,849
different things that could go on so I

1133
00:44:04,809 --> 00:44:09,519
I'm just running Python scripts that

1134
00:44:06,849 --> 00:44:11,110
call these functions that people smarter

1135
00:44:09,519 --> 00:44:13,239
than me i've already written that's

1136
00:44:11,110 --> 00:44:15,460
right no you that that's a big effort

1137
00:44:13,239 --> 00:44:17,500
here at the in suits called Eureka re ka

1138
00:44:15,460 --> 00:44:19,389
and it's a really important astronomy

1139
00:44:17,500 --> 00:44:22,239
develop our software package for people

1140
00:44:19,389 --> 00:44:23,230
who use Hubble data so I'm glad glad you

1141
00:44:22,239 --> 00:44:25,479
gave the shout out I'm sure they'll

1142
00:44:23,230 --> 00:44:30,039
appreciate it I was using it today

1143
00:44:25,480 --> 00:44:31,809
earlier nah yeah endorsement Oh

1144
00:44:30,039 --> 00:44:33,070
and they'll be happy here that's them

1145
00:44:31,809 --> 00:44:34,570
with our science software branch here at

1146
00:44:33,070 --> 00:44:37,240
the Institute so that's really great I

1147
00:44:34,570 --> 00:44:38,800
have a dark-matter question from Michael

1148
00:44:37,239 --> 00:44:40,779
jobin hi Michael welcome back as I'm

1149
00:44:38,800 --> 00:44:43,060
always glad to see your questions he

1150
00:44:40,780 --> 00:44:47,230
wants to know how do we know dark matter

1151
00:44:43,059 --> 00:44:49,509
is a kind of particle only or not just

1152
00:44:47,230 --> 00:44:51,760
some bodies of some sort that we can't

1153
00:44:49,510 --> 00:44:55,120
see yet but you want to comment on that

1154
00:44:51,760 --> 00:44:56,980
Steve maybe or is it a cuddle sure no

1155
00:44:55,119 --> 00:44:58,359
welcome to that I saw the question min

1156
00:44:56,980 --> 00:45:02,130
ago and I was like oh that's a good

1157
00:44:58,360 --> 00:45:04,360
question ah so did we always give you a

1158
00:45:02,130 --> 00:45:05,440
particle physicist provide a much better

1159
00:45:04,360 --> 00:45:08,410
answer but I will provide an

1160
00:45:05,440 --> 00:45:09,970
Astrophysical answer which is we can see

1161
00:45:08,409 --> 00:45:13,029
that the densities and the Centers of

1162
00:45:09,969 --> 00:45:14,739
galaxies are really high and this is

1163
00:45:13,030 --> 00:45:16,870
just a guess but I'm guessing that if it

1164
00:45:14,739 --> 00:45:18,519
was due to actual regular matter like

1165
00:45:16,869 --> 00:45:20,440
say a bunch of asteroids or something

1166
00:45:18,519 --> 00:45:23,230
like that there would have to be so many

1167
00:45:20,440 --> 00:45:24,820
did either a you would see them or be

1168
00:45:23,230 --> 00:45:26,800
they would prevent things from moving

1169

00:45:24,820 --> 00:45:28,090
around in their orbits so stars and

1170
00:45:26,800 --> 00:45:30,220
other things will be smashing into it

1171
00:45:28,090 --> 00:45:32,710
all the time and that would cause things

1172
00:45:30,219 --> 00:45:35,879
to glow and we would see it good

1173
00:45:32,710 --> 00:45:38,079
question that is that is an answer there

1174
00:45:35,880 --> 00:45:39,670
that's right there's a lot about dark

1175
00:45:38,079 --> 00:45:41,259
matter we're still trying to find out so

1176
00:45:39,670 --> 00:45:43,869
according to the press release I was

1177
00:45:41,260 --> 00:45:45,550
just reading here and the next area open

1178
00:45:43,869 --> 00:45:47,859
that follows from what you guys are

1179
00:45:45,550 --> 00:45:50,170
doing is that you want to kind of look

1180
00:45:47,860 --> 00:45:51,820
in the x-rays next to see what's going

1181
00:45:50,170 --> 00:45:54,220
on with some of this primordial stuff

1182
00:45:51,820 --> 00:45:56,920
that's out there because the earliest

1183
00:45:54,219 --> 00:45:58,689

stars they were they were very large and

1184

00:45:56,920 --> 00:46:02,559

they collapsed really quickly because

1185

00:45:58,690 --> 00:46:03,700

they were so large and so and so they

1186

00:46:02,559 --> 00:46:05,320

did this thing called up what was I

1187

00:46:03,699 --> 00:46:07,599

forget the name now because the core

1188

00:46:05,320 --> 00:46:09,100

core collapse I forget when I i forget

1189

00:46:07,599 --> 00:46:11,619

the kind of supernova it was it was a

1190

00:46:09,099 --> 00:46:14,980

very special kind anyway and those would

1191

00:46:11,619 --> 00:46:16,599

show up in the x-ray so are there any

1192

00:46:14,980 --> 00:46:18,070

plans for you guys to be doing some

1193

00:46:16,599 --> 00:46:21,519

x-ray work or is that other members of

1194

00:46:18,070 --> 00:46:24,010

the team I actually just sent a draft

1195

00:46:21,519 --> 00:46:27,190

around about extra cross-correlations

1196

00:46:24,010 --> 00:46:29,950

yesterday so the collaborators so yeah

1197

00:46:27,190 --> 00:46:32,110

we are we are doing that we r cross

1198
00:46:29,949 --> 00:46:35,409
correlating x-ray background maps with

1199
00:46:32,110 --> 00:46:37,390
the maps that i made in Hubble so the

1200
00:46:35,409 --> 00:46:38,889
idea is that if there's a black hole

1201
00:46:37,389 --> 00:46:41,049
signature in the really early universe

1202
00:46:38,889 --> 00:46:42,909
they would leave imprints on the cosmic

1203
00:46:41,050 --> 00:46:43,760
infrared background which is what we

1204
00:46:42,909 --> 00:46:45,859
have maps up

1205
00:46:43,760 --> 00:46:48,410
so if we cross-correlate maps between

1206
00:46:45,860 --> 00:46:50,240
the near infrared and the x-ray then if

1207
00:46:48,409 --> 00:46:51,710
there's a strong correlation that that

1208
00:46:50,239 --> 00:46:55,129
kind of hints that may be that the

1209
00:46:51,710 --> 00:46:56,420
possibilities is true oh boy this is one

1210
00:46:55,130 --> 00:46:58,130
of those moments where I just you know I

1211
00:46:56,420 --> 00:47:00,409
just hit it just hit me of course there

1212
00:46:58,130 --> 00:47:01,910
would be a background infrared map all I

1213
00:47:00,409 --> 00:47:03,079
ever think we always think about is

1214
00:47:01,909 --> 00:47:05,449
microwave background you know where I

1215
00:47:03,079 --> 00:47:07,519
was thinking about that is there is this

1216
00:47:05,449 --> 00:47:09,439
this infrared map is it is it the whole

1217
00:47:07,519 --> 00:47:10,789
sky thing or is that most of the sky or

1218
00:47:09,440 --> 00:47:12,920
no it's that it's what we've been

1219
00:47:10,789 --> 00:47:15,800
talking about it's the the whole the

1220
00:47:12,920 --> 00:47:17,180
whole maps the whole the whole cluster

1221
00:47:15,800 --> 00:47:21,019
the whole candles feel then the whole

1222
00:47:17,179 --> 00:47:22,849
clans cluster survey well I after all of

1223
00:47:21,019 --> 00:47:24,349
the work that I did to try to get

1224
00:47:22,849 --> 00:47:27,019
mosaics in all the fields I can only do

1225
00:47:24,349 --> 00:47:30,139
it in two fields okay because it's kind

1226

00:47:27,019 --> 00:47:31,940
of a data constraint but yeah basically

1227
00:47:30,139 --> 00:47:33,259
just cross correlating with the maps

1228
00:47:31,940 --> 00:47:36,110
that i already have from the work that i

1229
00:47:33,260 --> 00:47:38,680
did in this paper i can just cross

1230
00:47:36,110 --> 00:47:41,150
correlate with x-ray maps and

1231
00:47:38,679 --> 00:47:42,799
investigate that very good okay well

1232
00:47:41,150 --> 00:47:44,930
that's great all right well I don't know

1233
00:47:42,800 --> 00:47:45,980
if there's any other quick on emma is

1234
00:47:44,929 --> 00:47:48,259
there anything i'm missing on twitter

1235
00:47:45,980 --> 00:47:50,329
anything you want to point out or we

1236
00:47:48,260 --> 00:47:52,610
good to go no I think we're pretty good

1237
00:47:50,329 --> 00:47:55,039
okay all right all right folks well i

1238
00:47:52,610 --> 00:47:57,769
guess i will do it this week next week

1239
00:47:55,039 --> 00:48:00,320
we all have a hangout plan for you that

1240
00:47:57,769 --> 00:48:02,150

i'm gonna have I Carol I don't get what

1241

00:48:00,320 --> 00:48:04,850

it says a you Mick can you describe what

1242

00:48:02,150 --> 00:48:07,880

that what that was what it was what we

1243

00:48:04,849 --> 00:48:11,089

got next week America is that well I

1244

00:48:07,880 --> 00:48:15,980

also want to say NASA's is pushing a

1245

00:48:11,090 --> 00:48:19,309

little bit in October the exoplanet

1246

00:48:15,980 --> 00:48:21,230

research there's also the division of

1247

00:48:19,309 --> 00:48:26,389

planetary science to have any meeting

1248

00:48:21,230 --> 00:48:29,360

and all that so au mech was known to

1249

00:48:26,389 --> 00:48:32,599

have is an exoplanet system is known to

1250

00:48:29,360 --> 00:48:34,849

have a disc and it has been observed

1251

00:48:32,599 --> 00:48:38,480

both by Hubble and other instrumentation

1252

00:48:34,849 --> 00:48:42,079

and seems to have some funny things

1253

00:48:38,480 --> 00:48:43,789

about the disk and so this woman we're

1254

00:48:42,079 --> 00:48:45,380

going to talk with the authors about how

1255
00:48:43,789 --> 00:48:47,090
they use the Hubble data and what they

1256
00:48:45,380 --> 00:48:49,280
are learning about this disk you know

1257
00:48:47,090 --> 00:48:50,990
this one isn't it's not like oh oh it

1258
00:48:49,280 --> 00:48:52,910
has a disk you know it's it's known to

1259
00:48:50,989 --> 00:48:55,189
have a debris disk and so it's like

1260
00:48:52,909 --> 00:48:57,549
they're now kind of looking at it and

1261
00:48:55,190 --> 00:49:01,150
seeing this is another case all

1262
00:48:57,550 --> 00:49:03,280
so using multiple telescopes observing

1263
00:49:01,150 --> 00:49:07,210
something over a period of time so it

1264
00:49:03,280 --> 00:49:09,370
shows why that kind of research is

1265
00:49:07,210 --> 00:49:12,010
worthwhile so it's basically about an

1266
00:49:09,369 --> 00:49:13,599
exoplanet and that is next week folks so

1267
00:49:12,010 --> 00:49:15,190
I hope you'll join us i want to thank i

1268
00:49:13,599 --> 00:49:16,960
want to thank you guys for don't think

1269
00:49:15,190 --> 00:49:19,450
our guests catcher Mitchell when he's uh

1270
00:49:16,960 --> 00:49:20,559
from UC Irvine thank you so much for

1271
00:49:19,449 --> 00:49:22,419
taking the time out to talk to us about

1272
00:49:20,559 --> 00:49:24,250
your research it's been an awesome stuff

1273
00:49:22,420 --> 00:49:26,409
and I hope you'll come back after you do

1274
00:49:24,250 --> 00:49:28,719
the x-ray stuff and yeah and follow up

1275
00:49:26,409 --> 00:49:30,519
okay good luck today and good luck to

1276
00:49:28,719 --> 00:49:31,989
you everyone thanks for and dr. Stephen

1277
00:49:30,519 --> 00:49:34,480
Finkelstein he's also the astronomer

1278
00:49:31,989 --> 00:49:35,799
from University of Texas at Austin thank

1279
00:49:34,480 --> 00:49:37,539
you Steve for coming back it's always

1280
00:49:35,800 --> 00:49:39,310
great to have you on a hangouts and he's

1281
00:49:37,539 --> 00:49:42,279
going to be back with us at the end of

1282
00:49:39,309 --> 00:49:43,570
the month so well I was it I didn't look

1283

00:49:42,280 --> 00:49:45,580
that far ahead is that true great

1284
00:49:43,570 --> 00:49:48,430
outstanding I look forward to talking to

1285
00:49:45,579 --> 00:49:51,099
you again ste absolutely it don't look

1286
00:49:48,429 --> 00:49:52,629
good all right all right Carol Scott

1287
00:49:51,099 --> 00:49:56,469
thank you very much oh that's different

1288
00:49:52,630 --> 00:49:57,760
mom yeah thank you uh that's it for this

1289
00:49:56,469 --> 00:50:00,159
week's folks thank you all for watching

1290
00:49:57,760 --> 00:50:02,530
and as always don't forget about soho

1291
00:50:00,159 --> 00:50:05,319
i'm telling you you don't forget how

1292
00:50:02,530 --> 00:50:09,570
soho that's right twenty years no we're

1293
00:50:05,320 --> 00:50:09,570
getting about soho is that no no yeah

1294
00:50:10,139 --> 00:50:17,829
don't you see no no no all right that's

1295
00:50:13,000 --> 00:50:21,059
it we're done thank you all for an XP

1296
00:50:17,829 --> 00:50:21,059
gradually looking up