
Google+
HUBBLE
hangouts
Ian O'Neill
Michael A. Phillips
Scott Lewis | KnowTheCosmos
Tony Darnell

1
00:00:10,390 --> 00:00:07,829
hello hubble huggers

2
00:00:12,549 --> 00:00:10,400
we are still waiting for people to show

3
00:00:14,470 --> 00:00:12,559
up but um we wanted i wanted to go ahead

4
00:00:17,109 --> 00:00:14,480
and get started because

5
00:00:18,470 --> 00:00:17,119
it is uh it is way past time for us to

6
00:00:19,750 --> 00:00:18,480
start and i didn't want to keep people

7
00:00:22,230 --> 00:00:19,760
waiting so

8
00:00:23,750 --> 00:00:22,240
um my name is tony darnell i'm with the

9
00:00:26,150 --> 00:00:23,760
space telescope science institute i'm

10
00:00:29,109 --> 00:00:26,160
the social media manager here and

11
00:00:30,390 --> 00:00:29,119
we are all this week we are having uh

12
00:00:31,509 --> 00:00:30,400
something called

13
00:00:33,110 --> 00:00:31,519

the institute is holding something

14
00:00:35,190 --> 00:00:33,120
called an orion

15
00:00:37,590 --> 00:00:35,200
nebula workshop and basically what

16
00:00:39,190 --> 00:00:37,600
they're trying to do is uh highlight

17
00:00:41,350 --> 00:00:39,200
some of the most recent research that's

18
00:00:44,549 --> 00:00:41,360
being done in their orion nebula and

19
00:00:46,310 --> 00:00:44,559
today is our second of two uh hangouts

20
00:00:48,630 --> 00:00:46,320
that we were gonna have on this now

21
00:00:51,110 --> 00:00:48,640
yesterday we had some of the the uh

22
00:00:53,350 --> 00:00:51,120
workshop participants in there uh with

23
00:00:55,110 --> 00:00:53,360
massimo roberto one of the uh one of the

24
00:00:56,310 --> 00:00:55,120
astronomers who was chairing the

25
00:00:58,630 --> 00:00:56,320
workshop

26
00:00:59,910 --> 00:00:58,640
and uh i have

27
00:01:02,549 --> 00:00:59,920
uh he has

28
00:01:04,950 --> 00:01:02,559
he's probably i imagine um having some

29
00:01:07,590 --> 00:01:04,960
technical difficulties because last time

30
00:01:08,950 --> 00:01:07,600
he joined straight from the uh the uh

31
00:01:10,789 --> 00:01:08,960
conference room which was right outside

32
00:01:12,230 --> 00:01:10,799
one of the venues there so hopefully

33
00:01:15,109 --> 00:01:12,240
he'll be joining us soon i'll be

34
00:01:17,109 --> 00:01:15,119
checking my email to make sure that uh

35
00:01:18,550 --> 00:01:17,119
that he's uh gonna be able to join us

36
00:01:19,749 --> 00:01:18,560
here pretty soon too

37
00:01:21,190 --> 00:01:19,759
um

38
00:01:23,429 --> 00:01:21,200

and

39
00:01:26,630 --> 00:01:23,439
usually who's also with me here is uh

40
00:01:29,030 --> 00:01:26,640
scott lewis but he apparently moved to

41
00:01:31,350 --> 00:01:29,040
somalia because he doesn't have any

42
00:01:34,789 --> 00:01:31,360
power that guy he's always running out

43
00:01:36,550 --> 00:01:34,799
of power every time i i gotta go and uh

44
00:01:37,590 --> 00:01:36,560
go to the go to the office in the in the

45
00:01:38,870 --> 00:01:37,600
astronomy department or something

46
00:01:40,390 --> 00:01:38,880
because he doesn't have any electricity

47
00:01:41,429 --> 00:01:40,400
or internet is out or something like

48
00:01:44,469 --> 00:01:41,439
that so

49
00:01:46,230 --> 00:01:44,479
um i think he lives in california but i

50
00:01:48,389 --> 00:01:46,240
can't be sure based on the reliability

51
00:01:50,310 --> 00:01:48,399
of his uh infrastructure the biggest

52
00:01:52,630 --> 00:01:50,320
biggest city in the country i don't know

53
00:01:54,789 --> 00:01:52,640
yeah i don't know either so

54
00:01:56,710 --> 00:01:54,799
anyway um he should be joining us

55
00:01:58,550 --> 00:01:56,720
shortly i hope he's getting set up

56
00:01:59,749 --> 00:01:58,560
somewhere and he'll be able to

57
00:02:03,190 --> 00:01:59,759
participate

58
00:02:05,350 --> 00:02:03,200
at some point um also uh with me today

59
00:02:07,670 --> 00:02:05,360
is uh is michael phillips he was here

60
00:02:10,229 --> 00:02:07,680
yesterday hi michael hey

61
00:02:12,550 --> 00:02:10,239
hi he's an amateur astrophotographer who

62
00:02:14,630 --> 00:02:12,560
uh has taken quite a few images of the

63
00:02:16,070 --> 00:02:14,640

orion nebula and uh we told we showed

64
00:02:17,670 --> 00:02:16,080
some of them yesterday and he's on he

65
00:02:19,350 --> 00:02:17,680
was also showing me some of his right

66
00:02:21,589 --> 00:02:19,360
now and we're going to show you some of

67
00:02:23,030 --> 00:02:21,599
them as well after i do a little summary

68
00:02:26,550 --> 00:02:23,040
and introduce

69
00:02:27,589 --> 00:02:26,560
uh dr ian o'neal hello ian hi there tony

70
00:02:29,350 --> 00:02:27,599
how are you doing

71
00:02:30,869 --> 00:02:29,360
i'm good thank you thanks for joining us

72
00:02:32,790 --> 00:02:30,879
he is the uh

73
00:02:33,750 --> 00:02:32,800
commander-in-chief over discovery news

74
00:02:35,509 --> 00:02:33,760
right

75
00:02:37,830 --> 00:02:35,519
um of the space section yeah of the

76
00:02:39,270 --> 00:02:37,840
space i'd love to own it all but i can't

77
00:02:40,949 --> 00:02:39,280
well it's the only one it's the only one

78
00:02:43,030 --> 00:02:40,959
worth it anyway right it's the only one

79
00:02:43,910 --> 00:02:43,040
absolutely yeah you know the deal

80
00:02:46,869 --> 00:02:43,920
yeah

81
00:02:48,630 --> 00:02:46,879
anyway thanks for joining us so uh

82
00:02:49,830 --> 00:02:48,640
yeah it's a real treat so i was just

83
00:02:51,430 --> 00:02:49,840
telling people right but right when you

84
00:02:53,350 --> 00:02:51,440
were joining that

85
00:02:54,630 --> 00:02:53,360
uh all this week at the institute the

86
00:02:56,550 --> 00:02:54,640
space telescope science institute we're

87
00:02:59,270 --> 00:02:56,560
having this uh

88
00:03:00,869 --> 00:02:59,280

orion nebula workshop and

89
00:03:03,350 --> 00:03:00,879
one of the things i'm experimenting with

90
00:03:05,110 --> 00:03:03,360
here as my new job here with social

91
00:03:08,390 --> 00:03:05,120
media at the institute is i want to try

92
00:03:09,589 --> 00:03:08,400
and get some of these uh workshops and

93
00:03:10,949 --> 00:03:09,599
some of the science some of the talks

94
00:03:12,869 --> 00:03:10,959
that we're doing at the institute out to

95
00:03:16,229 --> 00:03:12,879
the general public so this is the first

96
00:03:18,390 --> 00:03:16,239
one i've tried this year uh the uh

97
00:03:19,589 --> 00:03:18,400
the workshops going on from monday

98
00:03:21,030 --> 00:03:19,599
wednesday or monday tuesday and

99
00:03:22,470 --> 00:03:21,040
wednesday it ends tomorrow but tomorrow

100
00:03:23,910 --> 00:03:22,480
we won't have a hangout based on that

101
00:03:26,149 --> 00:03:23,920
because there's just too many other

102
00:03:29,190 --> 00:03:26,159
things going on and roberto and i had

103
00:03:30,789 --> 00:03:29,200
our massimo and i had talked about

104
00:03:32,070 --> 00:03:30,799
getting some astronomers together to

105
00:03:34,390 --> 00:03:32,080
talk about their latest research and we

106
00:03:37,110 --> 00:03:34,400
did that yesterday i don't know where he

107
00:03:38,630 --> 00:03:37,120
is today i hope there's not any uh he

108
00:03:40,470 --> 00:03:38,640
may not make it i don't know i'm still

109
00:03:41,910 --> 00:03:40,480
waiting i'm still checking my email

110
00:03:44,550 --> 00:03:41,920
furiously to see you guys send him the

111
00:03:46,869 --> 00:03:44,560
link to the hangout oh here we go

112
00:03:48,710 --> 00:03:46,879
running late should be on in five

113
00:03:51,030 --> 00:03:48,720

minutes he says okay good hope they

114
00:03:52,869 --> 00:03:51,040
didn't lose power too

115
00:03:55,030 --> 00:03:52,879
i hope no i think things are fine here

116
00:03:58,390 --> 00:03:55,040
well baltimore tends to do pretty well

117
00:04:00,390 --> 00:03:58,400
so yesterday we learned just again

118
00:04:01,750 --> 00:04:00,400
to sort of summarize what

119
00:04:02,949 --> 00:04:01,760
happened yesterday for those of you who

120
00:04:05,110 --> 00:04:02,959
couldn't watch the hangout although you

121
00:04:06,470 --> 00:04:05,120
can go watch it on youtube um there was

122
00:04:09,030 --> 00:04:06,480
a lot of really cool things we had dr

123
00:04:11,110 --> 00:04:09,040
lynn hildebrandt on here and uh she

124
00:04:12,070 --> 00:04:11,120
taught us a lot about this she was

125
00:04:13,350 --> 00:04:12,080
really interested in stellar

126
00:04:15,429 --> 00:04:13,360
distributions of what's going on in the

127
00:04:17,749 --> 00:04:15,439
orion nebula and i guess the thing that

128
00:04:19,349 --> 00:04:17,759
i came away with the most yesterday was

129
00:04:22,550 --> 00:04:19,359
this sort of

130
00:04:24,629 --> 00:04:22,560
amazement that with something so

131
00:04:27,270 --> 00:04:24,639
familiar in our night sky like the orion

132
00:04:29,110 --> 00:04:27,280
nebula we are still out there actively

133
00:04:30,550 --> 00:04:29,120
studying it and learning new things

134
00:04:32,230 --> 00:04:30,560
about it even today the hubble space

135
00:04:34,629 --> 00:04:32,240
telescope actually spends a lot of time

136
00:04:37,270 --> 00:04:34,639
observing the orion nebula i didn't know

137
00:04:40,310 --> 00:04:37,280
that another thing i learned yesterday

138
00:04:43,110 --> 00:04:40,320

was that massimo said that there was a

139
00:04:44,710 --> 00:04:43,120
sort of a i keep wanting to use the word

140
00:04:49,830 --> 00:04:44,720
bias but that's not what i mean there's

141
00:04:53,909 --> 00:04:52,469
that sort of stop

142
00:04:55,990 --> 00:04:53,919
most of the stars in the orion nebula

143
00:04:58,790 --> 00:04:56,000
that get formed

144
00:05:02,070 --> 00:04:58,800
are right about the ones the the same

145
00:05:03,909 --> 00:05:02,080
size as when stellar fusion first starts

146
00:05:05,909 --> 00:05:03,919
and then they stop they they don't get

147
00:05:07,749 --> 00:05:05,919
very they don't get any bigger

148
00:05:10,550 --> 00:05:07,759
which i found was a pretty interesting

149
00:05:12,629 --> 00:05:10,560
um statistic i mean most of the you know

150
00:05:14,150 --> 00:05:12,639
the stars that form in that complex tend

151
00:05:18,790 --> 00:05:14,160
to

152
00:05:21,270 --> 00:05:18,800
stage where they just ignite stellar

153
00:05:22,710 --> 00:05:21,280
fusion and that's as big as they get um

154
00:05:24,310 --> 00:05:22,720
that you know those are the that's the

155
00:05:26,390 --> 00:05:24,320
masses of most of the stars and of

156
00:05:28,950 --> 00:05:26,400
course there's a lot of blue giants and

157
00:05:31,110 --> 00:05:28,960
and giant stars there as well as uh

158
00:05:32,950 --> 00:05:31,120
brown dwarfs a whole distribution of

159
00:05:34,390 --> 00:05:32,960
those as well but i thought that was a

160
00:05:37,110 --> 00:05:34,400
pretty interesting thing

161
00:05:39,670 --> 00:05:37,120
that i did not know before and finally

162
00:05:41,189 --> 00:05:39,680
the sort of the i don't know maybe i

163
00:05:42,390 --> 00:05:41,199

should have known this and i said this

164
00:05:44,550 --> 00:05:42,400
is probably one of the things i should

165
00:05:46,550 --> 00:05:44,560
have known but

166
00:05:48,790 --> 00:05:46,560
massimo was also saying yesterday that

167
00:05:51,110 --> 00:05:48,800
most of the stars in the constellation

168
00:05:53,189 --> 00:05:51,120
orion that's not just the nebula complex

169
00:05:54,790 --> 00:05:53,199
but the entire constellation most of

170
00:05:56,950 --> 00:05:54,800
those stars

171
00:05:59,270 --> 00:05:56,960
are about the same distance away they're

172
00:06:01,990 --> 00:05:59,280
kind of in a plane do you guys remember

173
00:06:03,430 --> 00:06:02,000
that uh cosmos episode where carl sagan

174
00:06:05,590 --> 00:06:03,440
showed the big dipper

175
00:06:08,469 --> 00:06:05,600
and then we kind of went around the big

176
00:06:09,909 --> 00:06:08,479
dipper in some some big circle and then

177
00:06:11,270 --> 00:06:09,919
we could see when we got like 90 degrees

178
00:06:13,110 --> 00:06:11,280
away from the from the big dipper you

179
00:06:14,710 --> 00:06:13,120
could see that it didn't look like a big

180
00:06:16,390 --> 00:06:14,720
uh the big dipper anymore it looked like

181
00:06:18,230 --> 00:06:16,400
something completely different do you

182
00:06:20,230 --> 00:06:18,240
guys remember that episode yeah there's

183
00:06:21,990 --> 00:06:20,240
some cool 3d graphics with it you kind

184
00:06:24,070 --> 00:06:22,000
of felt yeah 70s

185
00:06:25,350 --> 00:06:24,080
yeah yeah remember that a nice 70s style

186
00:06:26,790 --> 00:06:25,360
computer graphics

187
00:06:28,230 --> 00:06:26,800
well that was a good illustration it was

188
00:06:30,390 --> 00:06:28,240

the first time i had ever learned that

189
00:06:32,070 --> 00:06:30,400
the stars in the constellation

190
00:06:33,670 --> 00:06:32,080
and the stars and constellations weren't

191
00:06:35,350 --> 00:06:33,680
in the nice little flat plane that they

192
00:06:37,029 --> 00:06:35,360
look like they are to us they can be

193
00:06:37,909 --> 00:06:37,039
somewhere really close some are very far

194
00:06:40,629 --> 00:06:37,919
away

195
00:06:42,469 --> 00:06:40,639
uh well the orion nebula more or less is

196
00:06:45,029 --> 00:06:42,479
in a plane the stars in the make up the

197
00:06:46,950 --> 00:06:45,039
orion constellation i mean so that was

198
00:06:49,749 --> 00:06:46,960
something i i guess i should have known

199
00:06:51,510 --> 00:06:49,759
but i didn't um they're more or less

200
00:06:53,189 --> 00:06:51,520
in the same plane so it looks like

201
00:06:55,670 --> 00:06:53,199
massimo is with us let me get him in hi

202
00:06:58,150 --> 00:06:55,680
massimo can you hear me hi good evening

203
00:06:59,510 --> 00:06:58,160
hi so thanks

204
00:07:01,749 --> 00:06:59,520
thanks for joining us i was getting a

205
00:07:04,390 --> 00:07:01,759
little worried we are cooked i tell you

206
00:07:06,390 --> 00:07:04,400
this was a very long day and oh really

207
00:07:08,230 --> 00:07:06,400
they could not stop asking questions and

208
00:07:10,870 --> 00:07:08,240
the the

209
00:07:13,950 --> 00:07:10,880
the chair of the sessions were

210
00:07:16,870 --> 00:07:13,960
trying to cap stop stop it is a

211
00:07:18,230 --> 00:07:16,880
fascinating conference and it was the

212
00:07:19,990 --> 00:07:18,240
price to pay

213
00:07:21,670 --> 00:07:20,000

yeah then that's why you do that right i

214
00:07:24,710 --> 00:07:21,680
mean that's why you all get together so

215
00:07:26,070 --> 00:07:24,720
but that's all yeah man

216
00:07:27,510 --> 00:07:26,080
so can you give us a summary of what

217
00:07:29,909 --> 00:07:27,520
some of the highlights were today what

218
00:07:32,870 --> 00:07:29,919
were some of them today you know um

219
00:07:35,029 --> 00:07:32,880
yesterday we touched basically the the

220
00:07:38,070 --> 00:07:35,039
orion nebula cluster so what we see

221
00:07:39,830 --> 00:07:38,080
inside the nebula this evening

222
00:07:42,230 --> 00:07:39,840
this day we

223
00:07:44,150 --> 00:07:42,240
we went basically in two direction one

224
00:07:45,909 --> 00:07:44,160
we consider the nebula but under the

225
00:07:48,950 --> 00:07:45,919
point of view of uh

226
00:07:50,550 --> 00:07:48,960
as seen basically by uh different uh

227
00:07:52,070 --> 00:07:50,560
instruments at different wavelengths so

228
00:07:54,309 --> 00:07:52,080
we talked about

229
00:07:55,670 --> 00:07:54,319
uh x-ray emission

230
00:07:57,189 --> 00:07:55,680
and infrared

231
00:07:59,430 --> 00:07:57,199
mission and this has been very

232
00:08:01,670 --> 00:07:59,440
fascinating because this space satellite

233
00:08:02,629 --> 00:08:01,680
have done a fantastic job

234
00:08:04,629 --> 00:08:02,639
and

235
00:08:05,670 --> 00:08:04,639
basically what they have discovered is

236
00:08:07,270 --> 00:08:05,680
that

237
00:08:08,550 --> 00:08:07,280
is much more you know when you're not

238
00:08:10,790 --> 00:08:08,560

too much

239
00:08:13,670 --> 00:08:10,800
it's sort of bad because you cannot do

240
00:08:15,430 --> 00:08:13,680
any more uh these easy easy models not

241
00:08:18,309 --> 00:08:15,440
the spherical cows as they say the

242
00:08:21,909 --> 00:08:18,319
astrophysics do the astronomers do

243
00:08:23,990 --> 00:08:21,919
uh so it's it's very complicated and the

244
00:08:26,390 --> 00:08:24,000
the point that scared me a lot is the

245
00:08:29,830 --> 00:08:26,400
fact that the variability

246
00:08:32,149 --> 00:08:29,840
seems to play a critical a critical role

247
00:08:34,469 --> 00:08:32,159
the we have these thousands of stars in

248
00:08:36,310 --> 00:08:34,479
the orion nebula they are forming we

249
00:08:39,589 --> 00:08:36,320
would like to study them to understand

250
00:08:40,790 --> 00:08:39,599
one by one their master luminosity their

251
00:08:43,670 --> 00:08:40,800
age

252
00:08:45,590 --> 00:08:43,680
their accretion if they're still growing

253
00:08:47,190 --> 00:08:45,600
when they will start burning hydrogen so

254
00:08:49,430 --> 00:08:47,200
you take these pictures with the hubble

255
00:08:51,829 --> 00:08:49,440
with the benz instrument then you return

256
00:08:54,630 --> 00:08:51,839
after two weeks after eight days after

257
00:08:56,389 --> 00:08:54,640
two years they're completely different

258
00:08:58,870 --> 00:08:56,399
because they're variables because

259
00:09:00,949 --> 00:08:58,880
everything is changing and sometimes

260
00:09:03,110 --> 00:09:00,959
it's regular so there is an oscillation

261
00:09:05,990 --> 00:09:03,120
there is we call them periodic variables

262
00:09:06,790 --> 00:09:06,000
other times it's just sort of chaotic

263
00:09:11,350 --> 00:09:06,800

and

264
00:09:13,910 --> 00:09:11,360
need a lot of patience you need time

265
00:09:15,910 --> 00:09:13,920
with these telescopes which is expensive

266
00:09:18,630 --> 00:09:15,920
you have to convince the

267
00:09:21,190 --> 00:09:18,640
committees to to award you the time to

268
00:09:23,750 --> 00:09:21,200
give you know it's uh it's hard stuff

269
00:09:25,030 --> 00:09:23,760
it's complicated and it's hard that's a

270
00:09:26,230 --> 00:09:25,040
good point i mean a lot of people are

271
00:09:28,630 --> 00:09:26,240
clamoring to use the hubble space

272
00:09:29,829 --> 00:09:28,640
telescope so to to make the case that

273
00:09:31,110 --> 00:09:29,839
you keep wanting to look at the same

274
00:09:32,949 --> 00:09:31,120
things over and over again can be

275
00:09:35,190 --> 00:09:32,959
difficult absolutely the hubble and you

276
00:09:37,030 --> 00:09:35,200
know the chandra for the x-rays spitzer

277
00:09:40,150 --> 00:09:37,040
pizza is dead so now we don't have any

278
00:09:41,829 --> 00:09:40,160
more spitzer uh herschel is also is also

279
00:09:43,590 --> 00:09:41,839
run out of so

280
00:09:46,070 --> 00:09:43,600
all these satellites have

281
00:09:47,990 --> 00:09:46,080
a limited lifetime and actually i tell

282
00:09:49,829 --> 00:09:48,000
you a lot of work can

283
00:09:52,070 --> 00:09:49,839
can be done by amateur astronomers here

284
00:09:54,310 --> 00:09:52,080
because you really see even at optical

285
00:09:57,030 --> 00:09:54,320
wavelengths which are the basic one that

286
00:09:58,470 --> 00:09:57,040
we that we consider the first the easy

287
00:09:59,350 --> 00:09:58,480
ones we can you can do this from the

288
00:10:00,949 --> 00:09:59,360

ground

289
00:10:03,590 --> 00:10:00,959
we have this long-term

290
00:10:05,670 --> 00:10:03,600
monitoring program of orion not only the

291
00:10:07,750 --> 00:10:05,680
nebula but all the the entire orion

292
00:10:10,070 --> 00:10:07,760
constellation basically and there are

293
00:10:11,990 --> 00:10:10,080
these huge gaps because even

294
00:10:13,910 --> 00:10:12,000
even the observatories that try to do

295
00:10:15,910 --> 00:10:13,920
you know three weeks then there is day

296
00:10:18,630 --> 00:10:15,920
and night there are the clouds there is

297
00:10:20,470 --> 00:10:18,640
the bad weather so a network around

298
00:10:23,190 --> 00:10:20,480
around the earth of having three four

299
00:10:25,750 --> 00:10:23,200
five six centers that decide to spend

300
00:10:28,550 --> 00:10:25,760
time and to go night after night

301
00:10:30,710 --> 00:10:28,560
on certain selected regions

302
00:10:33,030 --> 00:10:30,720
uh that would be fantastic for us and we

303
00:10:35,110 --> 00:10:33,040
really miss this long-term monitoring

304
00:10:36,310 --> 00:10:35,120
and uh it's only a certain wavelength

305
00:10:38,550 --> 00:10:36,320
that's

306
00:10:39,670 --> 00:10:38,560
so you can get a good stuff to do there

307
00:10:42,150 --> 00:10:39,680
you can get a good handle on this

308
00:10:43,910 --> 00:10:42,160
variability just in optical the infrared

309
00:10:45,750 --> 00:10:43,920
variability just based on the optical

310
00:10:47,590 --> 00:10:45,760
wavelengths yeah but what is interesting

311
00:10:49,590 --> 00:10:47,600
is that they've shown today that when

312
00:10:51,269 --> 00:10:49,600
you do a comparison so there are there

313
00:10:53,030 --> 00:10:51,279

have been campaigns done with the

314
00:10:55,670 --> 00:10:53,040
infrared and the optical

315
00:10:58,310 --> 00:10:55,680
uh maybe even even from space to the

316
00:10:59,990 --> 00:10:58,320
infrared so the real true far infrared

317
00:11:02,790 --> 00:11:00,000
and you see in the infrared this nice

318
00:11:05,590 --> 00:11:02,800
periodicity and the optical

319
00:11:08,150 --> 00:11:05,600
maybe tracks and you go to another star

320
00:11:10,470 --> 00:11:08,160
just next door and that's completely

321
00:11:12,550 --> 00:11:10,480
uncorrelated they basically don't talk

322
00:11:16,230 --> 00:11:12,560
it should we don't know why

323
00:11:18,150 --> 00:11:16,240
ah so it's a zoo are there any resources

324
00:11:20,870 --> 00:11:18,160
available that amateurs can get can you

325
00:11:22,470 --> 00:11:20,880
can go to to see what kind of data you

326
00:11:24,710 --> 00:11:22,480
guys need or

327
00:11:26,310 --> 00:11:24,720
is there is there any i mean you said

328
00:11:28,069 --> 00:11:26,320
amateurs can be helpful well how can

329
00:11:29,670 --> 00:11:28,079
they find that out is there a place they

330
00:11:31,829 --> 00:11:29,680
can go

331
00:11:33,910 --> 00:11:31,839
so

332
00:11:35,509 --> 00:11:33,920
i i'm not an expert here i i must tell

333
00:11:36,949 --> 00:11:35,519
you i mean i know that i i have

334
00:11:38,470 --> 00:11:36,959
colleagues that work much more with

335
00:11:40,550 --> 00:11:38,480
amateurs and would be an interesting

336
00:11:43,750 --> 00:11:40,560
conversation to wave if we can have you

337
00:11:45,509 --> 00:11:43,760
know a wide range of people there is i

338
00:11:48,790 --> 00:11:45,519

know that there is this uh

339
00:11:52,630 --> 00:11:48,800
association of variable star observatory

340
00:11:59,829 --> 00:11:52,640
observers aa vso i think i know that

341
00:12:04,069 --> 00:12:02,069
i know too little about about that you

342
00:12:06,069 --> 00:12:04,079
know to throw here ideas but i would

343
00:12:08,069 --> 00:12:06,079
imagine that we could have a

344
00:12:10,230 --> 00:12:08,079
brainstorming at some point and maybe

345
00:12:13,110 --> 00:12:10,240
yeah you're giving me right

346
00:12:14,710 --> 00:12:13,120
a team of hardcore people uh that decide

347
00:12:16,870 --> 00:12:14,720
to monitor

348
00:12:19,110 --> 00:12:16,880
i selected the targets of course you

349
00:12:21,190 --> 00:12:19,120
need you know you you cannot just buy

350
00:12:22,389 --> 00:12:21,200
eye you need a ccd you need a decent

351
00:12:24,710 --> 00:12:22,399
place and

352
00:12:27,829 --> 00:12:24,720
and and the energy and the in the time

353
00:12:31,990 --> 00:12:27,839
to stay up a few hours whatever robotic

354
00:12:33,590 --> 00:12:32,000
telescope i i know little about that but

355
00:12:35,030 --> 00:12:33,600
most professionals yeah most

356
00:12:36,470 --> 00:12:35,040
professionals don't they don't they they

357
00:12:38,389 --> 00:12:36,480
just go to the telescope or they get

358
00:12:40,550 --> 00:12:38,399
their data then i tell you after a day

359
00:12:41,990 --> 00:12:40,560
like this it's exactly what we need at

360
00:12:43,269 --> 00:12:42,000
least for the optica starting with the

361
00:12:44,790 --> 00:12:43,279
article and then if you find a

362
00:12:46,550 --> 00:12:44,800
billionaire that does this with an

363
00:12:47,910 --> 00:12:46,560

infrared telescope

364
00:12:51,190 --> 00:12:47,920
or that

365
00:12:53,269 --> 00:12:51,200
or from space if if bill gates wants to

366
00:12:54,870 --> 00:12:53,279
do that that's a real billionaire

367
00:12:56,069 --> 00:12:54,880
yeah

368
00:12:59,269 --> 00:12:56,079
let's go get in touch with our

369
00:13:06,069 --> 00:12:59,279
billionaire friends tony and we can okay

370
00:13:10,069 --> 00:13:07,750
oh i thought you were still talking from

371
00:13:11,110 --> 00:13:10,079
like a hand turning crank generator or

372
00:13:13,509 --> 00:13:11,120
something

373
00:13:15,350 --> 00:13:13,519
yeah yeah so

374
00:13:18,470 --> 00:13:15,360
uh go ahead

375
00:13:20,310 --> 00:13:18,480
no just uh i'm late okay okay so so

376
00:13:22,550 --> 00:13:20,320
scott's late joining us because he's in

377
00:13:23,670 --> 00:13:22,560
uh he's he's transmitting from somalia

378
00:13:24,790 --> 00:13:23,680
or someplace like that he doesn't have

379
00:13:26,069 --> 00:13:24,800
any power

380
00:13:26,949 --> 00:13:26,079
yeah yeah

381
00:13:30,470 --> 00:13:26,959
so

382
00:13:32,470 --> 00:13:30,480
to invite you if you have any questions

383
00:13:34,870 --> 00:13:32,480
please uh by the way let me introduce uh

384
00:13:37,350 --> 00:13:34,880
who this is this is dr massimo roberto

385
00:13:39,750 --> 00:13:37,360
he is uh the chair of the workshop

386
00:13:41,269 --> 00:13:39,760
that's being held this week and uh he's

387
00:13:42,949 --> 00:13:41,279
an expert in the ryan nebula and star

388
00:13:44,870 --> 00:13:42,959

forming regions and things like that so

389
00:13:46,949 --> 00:13:44,880
by all means if you guys can think of

390
00:13:48,230 --> 00:13:46,959
anything go ahead michael you acted like

391
00:13:50,310 --> 00:13:48,240
you wanted to say something a while ago

392
00:13:52,629 --> 00:13:50,320
did i cut you off

393
00:13:54,790 --> 00:13:52,639
no i i i fully agree with the the

394
00:13:56,310 --> 00:13:54,800
amateur professional collaboration i i

395
00:13:57,910 --> 00:13:56,320
was telling tony before i'm very

396
00:13:59,829 --> 00:13:57,920
involved in a lot of planetary stuff and

397
00:14:02,069 --> 00:13:59,839
i know there's a lot of sharing between

398
00:14:03,430 --> 00:14:02,079
the professionals and the amateurs and i

399
00:14:05,670 --> 00:14:03,440
i too would be interested to hear more

400
00:14:07,829 --> 00:14:05,680
about the variable star observing

401
00:14:08,949 --> 00:14:07,839
programs and things like that so

402
00:14:10,310 --> 00:14:08,959
yeah

403
00:14:11,990 --> 00:14:10,320
there's a lot of really good things

404
00:14:13,590 --> 00:14:12,000
going on i know one of our streamers

405
00:14:15,350 --> 00:14:13,600
peter lake from the virtual star party

406
00:14:17,110 --> 00:14:15,360
is really involved in it we've done some

407
00:14:18,629 --> 00:14:17,120
photometry data live in the hangout on

408
00:14:19,910 --> 00:14:18,639
air like this before

409
00:14:23,110 --> 00:14:19,920
doing um

410
00:14:25,670 --> 00:14:23,120
we did a transit of an exoplanets live

411
00:14:27,829 --> 00:14:25,680
in a hangout and he was able to show the

412
00:14:29,750 --> 00:14:27,839
cur the light curves it was beautiful so

413
00:14:31,750 --> 00:14:29,760

there's a lot that that amateurs are

414
00:14:33,509 --> 00:14:31,760
able to do to collaborate worldwide

415
00:14:35,189 --> 00:14:33,519
because he's out of australia

416
00:14:37,030 --> 00:14:35,199
right so there's a lot that's able to be

417
00:14:37,829 --> 00:14:37,040
done the the

418
00:14:43,430 --> 00:14:37,839
uh

419
00:14:45,509 --> 00:14:43,440
the richest region

420
00:14:46,870 --> 00:14:45,519
within two kilo parsecs six thousand

421
00:14:50,310 --> 00:14:46,880
light years from the sun so it's a

422
00:14:52,150 --> 00:14:50,320
pretty decent uh area and uh and this is

423
00:14:53,910 --> 00:14:52,160
the place where you should look at

424
00:14:55,590 --> 00:14:53,920
because it's very dense there are many

425
00:14:58,310 --> 00:14:55,600
young stars

426
00:15:00,550 --> 00:14:58,320
we still have to discover a planet

427
00:15:03,670 --> 00:15:00,560
around one of these stars must be there

428
00:15:04,870 --> 00:15:03,680
transiting planet has never been seen

429
00:15:06,150 --> 00:15:04,880
uh

430
00:15:07,750 --> 00:15:06,160
and and

431
00:15:09,590 --> 00:15:07,760
you know would be very very interesting

432
00:15:11,910 --> 00:15:09,600
because would be not a planet around the

433
00:15:14,870 --> 00:15:11,920
star which is uh you know all the same

434
00:15:17,030 --> 00:15:14,880
age of the sun would be a forming planet

435
00:15:18,949 --> 00:15:17,040
right so if we could see if we could

436
00:15:21,110 --> 00:15:18,959
just discover it then we could go with

437
00:15:23,990 --> 00:15:21,120
the hubble with everything we could see

438
00:15:26,230 --> 00:15:24,000

the atmosphere this we could learn a lot

439
00:15:28,949 --> 00:15:26,240
but still we don't know where to look at

440
00:15:30,710 --> 00:15:28,959
what about an accretion disk

441
00:15:33,110 --> 00:15:30,720
excuse me

442
00:15:35,110 --> 00:15:33,120
go ahead ian i was just going to ask

443
00:15:37,269 --> 00:15:35,120
what kind of um how many stars what's

444
00:15:39,269 --> 00:15:37,279
the standard population in the the orion

445
00:15:41,430 --> 00:15:39,279
the nebula

446
00:15:44,150 --> 00:15:41,440
so in the orion nebula but the entire

447
00:15:46,389 --> 00:15:44,160
constellation basically is ignored south

448
00:15:49,670 --> 00:15:46,399
there is this monster filament

449
00:15:51,829 --> 00:15:49,680
actually is even more complex

450
00:15:54,150 --> 00:15:51,839
the orion nebula is like the hot spot of

451
00:15:57,590 --> 00:15:54,160
the region so the orion nebula hosts

452
00:15:59,430 --> 00:15:57,600
like 2-3 000 stars depends if you go in

453
00:16:02,629 --> 00:15:59,440
the infrared you can see stars that are

454
00:16:04,629 --> 00:16:02,639
not visible at visible wavelengths let's

455
00:16:07,670 --> 00:16:04,639
say three thousand stars overall is

456
00:16:09,910 --> 00:16:07,680
about one million years old one two we

457
00:16:11,509 --> 00:16:09,920
discuss it's very it's very hard to say

458
00:16:13,590 --> 00:16:11,519
you know when they're too young it's

459
00:16:15,189 --> 00:16:13,600
it's hard to be to be accurate because

460
00:16:17,269 --> 00:16:15,199
they are not born on the same day so

461
00:16:18,470 --> 00:16:17,279
there are scatter around and they're

462
00:16:21,030 --> 00:16:18,480
variables

463
00:16:23,430 --> 00:16:21,040

but they are young one two million years

464
00:16:25,430 --> 00:16:23,440
so all these stars have steered their

465
00:16:29,030 --> 00:16:25,440
most of the stars eighty percent more or

466
00:16:31,350 --> 00:16:29,040
less if still their circumstellar disks

467
00:16:33,670 --> 00:16:31,360
from which which is the last remnants of

468
00:16:34,790 --> 00:16:33,680
their forming uh

469
00:16:37,189 --> 00:16:34,800
cocoon

470
00:16:39,189 --> 00:16:37,199
and within the disks they are forming

471
00:16:40,550 --> 00:16:39,199
possibly we think is where they form

472
00:16:42,629 --> 00:16:40,560
planets and

473
00:16:44,389 --> 00:16:42,639
our solar system form within a disk we

474
00:16:46,389 --> 00:16:44,399
are on a plane the ecliptic plane is

475
00:16:47,990 --> 00:16:46,399
just the left over the

476
00:16:50,710 --> 00:16:48,000
fossil of the

477
00:16:53,110 --> 00:16:50,720
original disk in orion with the hubble

478
00:16:54,949 --> 00:16:53,120
we see disks around stars not around

479
00:16:56,949 --> 00:16:54,959
every star because maybe these disks are

480
00:16:59,030 --> 00:16:56,959
too small but we have about i don't know

481
00:17:00,949 --> 00:16:59,040
100 disks that we can really detect

482
00:17:02,949 --> 00:17:00,959
resolve but we think that almost every

483
00:17:04,630 --> 00:17:02,959
star is a disk and in these stars

484
00:17:07,110 --> 00:17:04,640
planets must fall

485
00:17:09,750 --> 00:17:07,120
we also see stars where this disc starts

486
00:17:11,829 --> 00:17:09,760
to be gone this is not really the orion

487
00:17:13,429 --> 00:17:11,839
nebula which is a little bit too young

488
00:17:14,230 --> 00:17:13,439

one million years the disk are still

489
00:17:16,470 --> 00:17:14,240
there

490
00:17:18,470 --> 00:17:16,480
but if we look a little bit around the

491
00:17:20,870 --> 00:17:18,480
orion but still in the constellation

492
00:17:23,189 --> 00:17:20,880
there are other associations

493
00:17:25,429 --> 00:17:23,199
we call the cluster is dense but when

494
00:17:28,710 --> 00:17:25,439
they start spreading they get older four

495
00:17:31,590 --> 00:17:28,720
five ten million years the disks are

496
00:17:34,470 --> 00:17:31,600
gone the planets are still forming there

497
00:17:37,029 --> 00:17:34,480
are still you know collapsing condensing

498
00:17:38,950 --> 00:17:37,039
they go around the star

499
00:17:40,630 --> 00:17:38,960
we are still to discover the first one

500
00:17:42,549 --> 00:17:40,640
but they are there

501
00:17:44,710 --> 00:17:42,559
because all these stars said the disc

502
00:17:47,909 --> 00:17:44,720
last week a few million years ago the

503
00:17:49,830 --> 00:17:47,919
disks were there they're just gone

504
00:17:51,909 --> 00:17:49,840
and these stars are

505
00:17:55,190 --> 00:17:51,919
variable they are they are sort of easy

506
00:17:56,390 --> 00:17:55,200
to find because of this crazy activity

507
00:18:05,510 --> 00:17:56,400
uh

508
00:18:09,590 --> 00:18:07,590
of course the variability of the star

509
00:18:11,430 --> 00:18:09,600
adds confusion if you want to study the

510
00:18:13,750 --> 00:18:11,440
passage of a planet because you have to

511
00:18:15,510 --> 00:18:13,760
find this little

512
00:18:18,310 --> 00:18:15,520
in front of the mess

513
00:18:21,669 --> 00:18:18,320

so it takes time it takes quality of the

514
00:18:23,510 --> 00:18:21,679
data it takes patience takes luck

515
00:18:25,750 --> 00:18:23,520
but the astronomers it's so hard to

516
00:18:27,029 --> 00:18:25,760
point the telescope in a certain region

517
00:18:29,830 --> 00:18:27,039
and spend

518
00:18:31,750 --> 00:18:29,840
several nights you can do

519
00:18:33,909 --> 00:18:31,760
maybe they give you a week

520
00:18:37,110 --> 00:18:33,919
but you know the long-term monitoring

521
00:18:38,950 --> 00:18:37,120
that you need it's uh

522
00:18:41,830 --> 00:18:38,960
has to be done

523
00:18:43,190 --> 00:18:41,840
so i was gonna use the word oh go ahead

524
00:18:45,190 --> 00:18:43,200
i was going to use the word accretion

525
00:18:46,710 --> 00:18:45,200
disk i think to to maybe describe some

526
00:18:48,230 --> 00:18:46,720
of the things that that your that the

527
00:18:49,909 --> 00:18:48,240
hubble has actually seen and witnessed

528
00:18:51,190 --> 00:18:49,919
but it sounds as though if that's the

529
00:18:52,870 --> 00:18:51,200
right term to use but it sounds as

530
00:18:54,630 --> 00:18:52,880
though you see some of those and then

531
00:18:56,390 --> 00:18:54,640
they go cold and then they're gone or

532
00:18:58,950 --> 00:18:56,400
not observable

533
00:19:01,110 --> 00:18:58,960
yeah the accretion means that the disc

534
00:19:03,110 --> 00:19:01,120
is basically the entire c the entire

535
00:19:04,710 --> 00:19:03,120
idea is that when you form you form a

536
00:19:07,270 --> 00:19:04,720
star because of graph

537
00:19:09,590 --> 00:19:07,280
right so if nothing would if you have

538
00:19:12,470 --> 00:19:09,600

everything standing there fixed

539
00:19:14,630 --> 00:19:12,480
gravity will will imagine a sphere with

540
00:19:16,310 --> 00:19:14,640
arrows that all point to the center so

541
00:19:18,470 --> 00:19:16,320
all particles will collapse to the

542
00:19:21,190 --> 00:19:18,480
center but if there is any tendency to

543
00:19:23,430 --> 00:19:21,200
rotate in this cloud together with the

544
00:19:26,070 --> 00:19:23,440
collapse to the center material we start

545
00:19:28,950 --> 00:19:26,080
to basically spiral down because it goes

546
00:19:30,630 --> 00:19:28,960
down but also keeps going around

547
00:19:31,830 --> 00:19:30,640
and so you see those things though right

548
00:19:35,270 --> 00:19:31,840
you actually have

549
00:19:37,669 --> 00:19:35,280
observables yeah you see you know in

550
00:19:39,590 --> 00:19:37,679
when you have a molecular material you

551
00:19:42,390 --> 00:19:39,600
can see this type of

552
00:19:44,150 --> 00:19:42,400
the spiral has never been see seen so

553
00:19:46,310 --> 00:19:44,160
easily because it's sort of a hard

554
00:19:48,870 --> 00:19:46,320
signal but we have clear evidence that

555
00:19:50,630 --> 00:19:48,880
the disc is basically the last phase of

556
00:19:52,310 --> 00:19:50,640
this of the ma of the

557
00:19:54,630 --> 00:19:52,320
of the accretion basically the star

558
00:19:56,789 --> 00:19:54,640
forms all the material that has not a

559
00:19:59,029 --> 00:19:56,799
lot of angular momentum as we call it

560
00:20:00,789 --> 00:19:59,039
goes straight to the center and so

561
00:20:02,549 --> 00:20:00,799
heavier elements that you can observe so

562
00:20:04,950 --> 00:20:02,559
you get a compositional structure for

563
00:20:07,350 --> 00:20:04,960

these things too at the beginning yes so

564
00:20:09,110 --> 00:20:07,360
at the very beginning we see is we see

565
00:20:11,270 --> 00:20:09,120
the formation of the core and we see

566
00:20:14,470 --> 00:20:11,280
maybe the core elongated within a sort

567
00:20:16,470 --> 00:20:14,480
of a ellipsoid and then when when when

568
00:20:18,870 --> 00:20:16,480
the star gets hotter and hotter starts

569
00:20:20,950 --> 00:20:18,880
to blow away the material and we can see

570
00:20:23,830 --> 00:20:20,960
it in the visible with the hubble we see

571
00:20:28,390 --> 00:20:23,840
the star the real photosphere

572
00:20:32,230 --> 00:20:29,510
disk of

573
00:20:34,710 --> 00:20:32,240
neutral obscure material still hanging

574
00:20:36,470 --> 00:20:34,720
there and with a little bit of mass that

575
00:20:38,870 --> 00:20:36,480
is still falling on the star and this is

576
00:20:41,029 --> 00:20:38,880
what we call accretion so these discs

577
00:20:43,029 --> 00:20:41,039
are still accreting eventually the

578
00:20:45,029 --> 00:20:43,039
accretion stops and what happens is

579
00:20:46,870 --> 00:20:45,039
actually when the accretion ends

580
00:20:49,590 --> 00:20:46,880
and we know that ends because there are

581
00:20:52,230 --> 00:20:49,600
certain phenomena that accretion

582
00:20:53,350 --> 00:20:52,240
produces h alpha emission ultraviolet

583
00:20:55,270 --> 00:20:53,360
excess

584
00:20:57,510 --> 00:20:55,280
we know we know we know how to measure

585
00:20:59,750 --> 00:20:57,520
accretion actually it's a very cool cool

586
00:21:02,630 --> 00:20:59,760
cool measure that we can do but at some

587
00:21:04,149 --> 00:21:02,640
point we don't see any more designs

588
00:21:07,029 --> 00:21:04,159

and then we understand that the disk is

589
00:21:08,710 --> 00:21:07,039
basically dissipated almost immediately

590
00:21:10,470 --> 00:21:08,720
so the lifetime of the disk is

591
00:21:12,950 --> 00:21:10,480
correlated to the time of a creation

592
00:21:15,510 --> 00:21:12,960
this either are accreting or they they

593
00:21:18,710 --> 00:21:15,520
disappear soon when they disappear the

594
00:21:19,750 --> 00:21:18,720
the the the fossil what remains

595
00:21:23,110 --> 00:21:19,760
we believe

596
00:21:26,310 --> 00:21:24,149
and do you

597
00:21:27,909 --> 00:21:26,320
do you think those planets would

598
00:21:29,590 --> 00:21:27,919
i if i'm remembering right from what we

599
00:21:32,870 --> 00:21:29,600
talked about yesterday didn't i hear you

600
00:21:35,430 --> 00:21:32,880
say that some of these uh discs are

601
00:21:37,510 --> 00:21:35,440
within a pixel of hubble the pixel scale

602
00:21:40,310 --> 00:21:37,520
is such that it doesn't fully get

603
00:21:42,710 --> 00:21:40,320
resolved the solar system the solar

604
00:21:44,149 --> 00:21:42,720
system if you take the solar system then

605
00:21:46,950 --> 00:21:44,159
basically you can say that the solar

606
00:21:49,270 --> 00:21:46,960
system for the solar system depends if

607
00:21:51,430 --> 00:21:49,280
you do the radius or diameter if you

608
00:21:53,510 --> 00:21:51,440
take blue when where it ends at some

609
00:21:55,669 --> 00:21:53,520
point what is the solar system but you

610
00:21:58,230 --> 00:21:55,679
know where the planets are

611
00:22:00,549 --> 00:21:58,240
is basically within one or two pixels of

612
00:22:04,950 --> 00:22:00,559
the hubble instruments so

613
00:22:07,750 --> 00:22:04,960

the region of planet formation to to to

614
00:22:10,070 --> 00:22:07,760
resolve a planet like a little point

615
00:22:12,390 --> 00:22:10,080
away from the star you will need a

616
00:22:14,310 --> 00:22:12,400
resolution a special resolution

617
00:22:16,950 --> 00:22:14,320
which is higher than the one of the

618
00:22:19,669 --> 00:22:16,960
harbor today you will see a planet more

619
00:22:22,470 --> 00:22:19,679
easily through the transit so if the

620
00:22:23,990 --> 00:22:22,480
planet if you have 1000 stars chances

621
00:22:27,029 --> 00:22:24,000
are that there are a few of them where

622
00:22:28,149 --> 00:22:27,039
the planets is passing in front of the

623
00:22:30,870 --> 00:22:28,159
star and

624
00:22:32,710 --> 00:22:30,880
and and back so transits eclipse

625
00:22:34,630 --> 00:22:32,720
are something that you should expect

626
00:22:36,310 --> 00:22:34,640
when you have enough statistics and

627
00:22:38,630 --> 00:22:36,320
especially it's easy if you get the

628
00:22:39,350 --> 00:22:38,640
planet close to the star

629
00:22:41,110 --> 00:22:39,360
so

630
00:22:42,789 --> 00:22:41,120
this is this is what you would like to

631
00:22:44,950 --> 00:22:42,799
get

632
00:22:47,350 --> 00:22:44,960
and then disentangling that though that

633
00:22:48,870 --> 00:22:47,360
that sort of transit variability for the

634
00:22:50,630 --> 00:22:48,880
planet moving in front of the star's

635
00:22:52,470 --> 00:22:50,640
light you still got to disentangle it

636
00:22:54,630 --> 00:22:52,480
with this other variability you said you

637
00:22:56,870 --> 00:22:54,640
were worried about at the beginning

638
00:22:58,870 --> 00:22:56,880

right yes yes absolutely but you know

639
00:22:59,990 --> 00:22:58,880
now you've got to somehow figure it out

640
00:23:02,950 --> 00:23:00,000
absolutely

641
00:23:05,350 --> 00:23:02,960
i mean there are i mean if if you have

642
00:23:06,630 --> 00:23:05,360
enough signal to noise if you have good

643
00:23:07,590 --> 00:23:06,640
measure

644
00:23:09,590 --> 00:23:07,600
uh

645
00:23:12,149 --> 00:23:09,600
there are ways to disentangle this for

646
00:23:13,669 --> 00:23:12,159
example a planet typically then we may

647
00:23:16,230 --> 00:23:13,679
discuss as much this is true but the

648
00:23:18,789 --> 00:23:16,240
planet is like a black disk and the

649
00:23:21,190 --> 00:23:18,799
black disc eats light at all wavelengths

650
00:23:22,870 --> 00:23:21,200
in the same way it's like a screen

651
00:23:24,789 --> 00:23:22,880
if you have spots if you have other

652
00:23:27,350 --> 00:23:24,799
stuff or if you have dust

653
00:23:29,909 --> 00:23:27,360
then there is a modulation because

654
00:23:31,350 --> 00:23:29,919
a cloud tends to be transparent in the

655
00:23:33,270 --> 00:23:31,360
infrared

656
00:23:36,149 --> 00:23:33,280
and and more opaque in the optical so

657
00:23:37,590 --> 00:23:36,159
the effort of clouds or hot spots or

658
00:23:39,510 --> 00:23:37,600
cold spots

659
00:23:41,909 --> 00:23:39,520
tends to be when you have multi-color

660
00:23:44,549 --> 00:23:41,919
observation tends to be different what

661
00:23:47,029 --> 00:23:44,559
would be nice is just to see

662
00:23:48,710 --> 00:23:47,039
a sign and then we may go with better

663
00:23:50,390 --> 00:23:48,720

instruments the professionals will go if

664
00:23:52,070 --> 00:23:50,400
they say ah this is where we have to go

665
00:23:55,669 --> 00:23:52,080
fact is that we don't really know where

666
00:24:00,149 --> 00:23:58,230
is it is it possible do you think that

667
00:24:01,909 --> 00:24:00,159
ground-based uh uh any ground-based

668
00:24:04,549 --> 00:24:01,919
telescopes i doubt it if

669
00:24:05,909 --> 00:24:04,559
if resolution is such an issue would be

670
00:24:07,830 --> 00:24:05,919
able to help much with finding or

671
00:24:09,830 --> 00:24:07,840
resolving any of these planets well as i

672
00:24:11,909 --> 00:24:09,840
said the eclipse is easy because you

673
00:24:15,510 --> 00:24:11,919
just measure light well so what you need

674
00:24:17,110 --> 00:24:15,520
is a good ccd camera a clear night and

675
00:24:19,350 --> 00:24:17,120
actually it's sort of easy because when

676
00:24:21,750 --> 00:24:19,360
you take a picture you take a picture of

677
00:24:23,909 --> 00:24:21,760
hundreds of stars so it's easy to

678
00:24:26,149 --> 00:24:23,919
measure if one is blinking versus all

679
00:24:28,230 --> 00:24:26,159
the others you you subtract one image

680
00:24:29,990 --> 00:24:28,240
from the next one five minutes after

681
00:24:32,230 --> 00:24:30,000
five minutes and you see immediately if

682
00:24:34,470 --> 00:24:32,240
there is any residual that

683
00:24:36,070 --> 00:24:34,480
pops up

684
00:24:38,230 --> 00:24:36,080
so the transit the variation in

685
00:24:40,549 --> 00:24:38,240
luminosity of the star

686
00:24:43,750 --> 00:24:40,559
is doable it's done actually

687
00:24:46,470 --> 00:24:43,760
uh the direct resolution of a planet

688
00:24:48,630 --> 00:24:46,480

close to the star as a tiny point next

689
00:24:49,510 --> 00:24:48,640
to a very bright star

690
00:24:52,070 --> 00:24:49,520
that's

691
00:24:54,390 --> 00:24:52,080
i would say beyond the reach not only of

692
00:24:55,669 --> 00:24:54,400
amateurs but of professional astronomers

693
00:24:57,990 --> 00:24:55,679
today

694
00:25:01,590 --> 00:24:58,000
because we do this but much closer orion

695
00:25:03,909 --> 00:25:01,600
is is 450 per sec and

696
00:25:05,590 --> 00:25:03,919
in this type of business is means far

697
00:25:07,110 --> 00:25:05,600
away right

698
00:25:09,190 --> 00:25:07,120
well i guess what worries me though is

699
00:25:11,110 --> 00:25:09,200
that you know the the uh

700
00:25:12,950 --> 00:25:11,120
you'll see these transits or these

701
00:25:14,549 --> 00:25:12,960
variable brightnesses from the stars but

702
00:25:16,710 --> 00:25:14,559
you're just because you can't resolve

703
00:25:18,630 --> 00:25:16,720
anything you just don't know really

704
00:25:19,909 --> 00:25:18,640
what causes because as you said but

705
00:25:21,750 --> 00:25:19,919
there's already this variability in the

706
00:25:23,269 --> 00:25:21,760
star to begin with so you know but if

707
00:25:25,350 --> 00:25:23,279
you if you know where to look for

708
00:25:28,950 --> 00:25:25,360
example the hubble this is i don't know

709
00:25:30,390 --> 00:25:28,960
if you if if our friends know this

710
00:25:32,230 --> 00:25:30,400
think about this

711
00:25:33,430 --> 00:25:32,240
you can have a planet that pass in front

712
00:25:35,990 --> 00:25:33,440
of the star

713
00:25:37,350 --> 00:25:36,000

the planet has a little atmosphere

714
00:25:38,950 --> 00:25:37,360
around

715
00:25:40,830 --> 00:25:38,960
so

716
00:25:43,830 --> 00:25:40,840
the passage of the

717
00:25:46,149 --> 00:25:43,840
planet has this atmosphere that is for

718
00:25:49,510 --> 00:25:46,159
example rich in sodium

719
00:25:53,909 --> 00:25:49,520
so this atmosphere may selectively

720
00:25:56,710 --> 00:25:53,919
decide to absorb this line of sodium so

721
00:25:59,029 --> 00:25:56,720
when the planet pass the entire spectrum

722
00:26:01,669 --> 00:25:59,039
goes down but the part where there is

723
00:26:03,510 --> 00:26:01,679
the sodium goes a little bit more down

724
00:26:04,950 --> 00:26:03,520
because there is an extra absorption

725
00:26:06,630 --> 00:26:04,960
which is the atmosphere it's like the

726
00:26:07,669 --> 00:26:06,640
planet in that line is a little bit

727
00:26:10,230 --> 00:26:07,679
larger

728
00:26:11,590 --> 00:26:10,240
oh this has been done so with the hubble

729
00:26:13,750 --> 00:26:11,600
we have we

730
00:26:14,710 --> 00:26:13,760
have been able to measure in certain

731
00:26:17,590 --> 00:26:14,720
cases

732
00:26:20,710 --> 00:26:17,600
the chemical composition of the planets

733
00:26:22,630 --> 00:26:20,720
around other stars this is uh star wars

734
00:26:24,310 --> 00:26:22,640
this is science fiction

735
00:26:26,870 --> 00:26:24,320
think about that the chemistry of the

736
00:26:29,909 --> 00:26:26,880
moon up there the atmospheres of planets

737
00:26:32,149 --> 00:26:29,919
around other stars is fantastic oh wow

738
00:26:34,390 --> 00:26:32,159

this is really great master if the

739
00:26:36,549 --> 00:26:34,400
amateur astronomers tell us we suspect

740
00:26:39,350 --> 00:26:36,559
that there is a planet there

741
00:26:41,190 --> 00:26:39,360
we look at it it's excited we don't know

742
00:26:42,870 --> 00:26:41,200
where to look today

743
00:26:44,870 --> 00:26:42,880
well you've given me a great idea today

744
00:26:47,029 --> 00:26:44,880
with this i want to i want to provide

745
00:26:49,190 --> 00:26:47,039
some resources to let amateurs know what

746
00:26:51,190 --> 00:26:49,200
kind of observations they could make to

747
00:26:53,110 --> 00:26:51,200
directly support your work and i think

748
00:26:54,870 --> 00:26:53,120
this would be uh something you'd get we

749
00:26:56,149 --> 00:26:54,880
get a lot of interest in so i'm hoping

750
00:26:56,870 --> 00:26:56,159
you know i'm gonna have to think about

751
00:26:59,909 --> 00:26:56,880
this

752
00:27:02,230 --> 00:26:59,919
peter met cool here in uh at the

753
00:27:04,230 --> 00:27:02,240
institute right is actually working on

754
00:27:06,789 --> 00:27:04,240
this and he has uh two or three amateur

755
00:27:09,590 --> 00:27:06,799
astronomers that help him and they have

756
00:27:12,070 --> 00:27:09,600
some results say they have discoveries

757
00:27:14,549 --> 00:27:12,080
uh uh but he's not observing orion so

758
00:27:15,990 --> 00:27:14,559
that's why i'm trying to

759
00:27:18,070 --> 00:27:16,000
okay well we'll see about getting you

760
00:27:19,269 --> 00:27:18,080
some getting some uh support for this

761
00:27:20,950 --> 00:27:19,279
too right so you're saying that

762
00:27:22,950 --> 00:27:20,960
long-term observations what's really

763
00:27:24,870 --> 00:27:22,960

needed right now something something on

764
00:27:27,029 --> 00:27:24,880
the order of a campaign or synoptical

765
00:27:28,710 --> 00:27:27,039
data that we could see over many weeks

766
00:27:30,870 --> 00:27:28,720
and months you asked me what came out

767
00:27:33,110 --> 00:27:30,880
today i would say this was one of the

768
00:27:36,390 --> 00:27:33,120
main points of the day clearly the need

769
00:27:38,149 --> 00:27:36,400
for for for long-term monitoring and to

770
00:27:40,149 --> 00:27:38,159
understand what's going on not only for

771
00:27:43,190 --> 00:27:40,159
the planets but really for for the for

772
00:27:44,310 --> 00:27:43,200
the status of the stars

773
00:27:46,310 --> 00:27:44,320
let me get some of these other guys in

774
00:27:47,590 --> 00:27:46,320
here go ahead ian yeah just had a quick

775
00:27:49,830 --> 00:27:47,600
question actually because um you're

776
00:27:52,310 --> 00:27:49,840
mentioning we need to uh you know have

777
00:27:54,950 --> 00:27:52,320
more focus on on this region of sky

778
00:27:57,669 --> 00:27:54,960
could the upcoming transiting exoplanet

779
00:27:59,190 --> 00:27:57,679
survey satellite the test satellite um

780
00:28:00,830 --> 00:27:59,200
there's going to be searching basically

781
00:28:03,750 --> 00:28:00,840
um kepler

782
00:28:05,750 --> 00:28:03,760
upgraded would that be able to

783
00:28:08,789 --> 00:28:05,760
perhaps slew to that area of the sky and

784
00:28:14,830 --> 00:28:11,909
uh it could but i don't know what they

785
00:28:18,549 --> 00:28:14,840
are planning uh sure

786
00:28:20,789 --> 00:28:18,559
uh i know about kepler kepler

787
00:28:22,870 --> 00:28:20,799
wanted to find planets and if you want

788
00:28:24,310 --> 00:28:22,880

to find planets you want to point a

789
00:28:26,310 --> 00:28:24,320
region of the sky where you have a

790
00:28:28,789 --> 00:28:26,320
zillion of stars

791
00:28:31,750 --> 00:28:28,799
and you don't want to see variability

792
00:28:33,430 --> 00:28:31,760
you you won't just have numbers and find

793
00:28:36,630 --> 00:28:33,440
a lot of them

794
00:28:38,389 --> 00:28:36,640
the case of orion is not the easiest

795
00:28:40,310 --> 00:28:38,399
place to go

796
00:28:43,029 --> 00:28:40,320
so i don't know if you want to take a

797
00:28:46,470 --> 00:28:43,039
mission of the caliber and start with

798
00:28:47,909 --> 00:28:46,480
orion maybe they do you know uh

799
00:28:49,750 --> 00:28:47,919
three years somewhere else and then they

800
00:28:51,830 --> 00:28:49,760
decide let's go in a young region and

801
00:28:53,269 --> 00:28:51,840
orion would be an excellent alex an

802
00:28:55,110 --> 00:28:53,279
excellent place to go

803
00:28:57,669 --> 00:28:55,120
but i

804
00:29:01,510 --> 00:28:57,679
i don't know and i suspect it's not the

805
00:29:02,870 --> 00:29:01,520
easiest place to go with the

806
00:29:06,149 --> 00:29:02,880
with the mission that with the with the

807
00:29:09,590 --> 00:29:07,669
i don't know what is their observing

808
00:29:11,669 --> 00:29:09,600
plan what their their strategy yeah

809
00:29:13,590 --> 00:29:11,679
suppose when it comes to uh the variable

810
00:29:15,190 --> 00:29:13,600
stars i mean how how many do i don't

811
00:29:17,830 --> 00:29:15,200
know if you know this but um

812
00:29:19,510 --> 00:29:17,840
how many uh variable stars have been uh

813
00:29:21,190 --> 00:29:19,520

observed with exoplanets so i mean

814
00:29:24,070 --> 00:29:21,200
because as you say kepler isn't

815
00:29:25,830 --> 00:29:24,080
necessarily um going to be looking at uh

816
00:29:27,350 --> 00:29:25,840
variable stars because they're it's very

817
00:29:29,430 --> 00:29:27,360
difficult to distinguish whether you

818
00:29:31,430 --> 00:29:29,440
know there's a dimming due to the

819
00:29:33,269 --> 00:29:31,440
transiting exoplanet or just variability

820
00:29:35,269 --> 00:29:33,279
in the star i

821
00:29:37,190 --> 00:29:35,279
i don't actually know

822
00:29:38,149 --> 00:29:37,200
you know with these variable stars how

823
00:29:40,630 --> 00:29:38,159
many

824
00:29:41,510 --> 00:29:40,640
um exoplanets have been discovered i

825
00:29:42,310 --> 00:29:41,520
mean

826
00:29:44,630 --> 00:29:42,320
um

827
00:29:47,110 --> 00:29:44,640
they can do some fantasy tricks with uh

828
00:29:48,630 --> 00:29:47,120
um you know with computing and software

829
00:29:50,549 --> 00:29:48,640
to actually distinguish whether you know

830
00:29:52,230 --> 00:29:50,559
there's a signature an exoplanet but

831
00:29:54,230 --> 00:29:52,240
that strikes me as a hard job to do as

832
00:29:56,149 --> 00:29:54,240
you say it's a hard job but i tell you

833
00:29:57,990 --> 00:29:56,159
it's even more fascinating if you think

834
00:29:59,350 --> 00:29:58,000
that the presence of exoplanet makes the

835
00:30:01,269 --> 00:29:59,360
star variable

836
00:30:03,190 --> 00:30:01,279
because you have to think about the fact

837
00:30:04,950 --> 00:30:03,200
that the exoplanet when it is close to

838
00:30:08,630 --> 00:30:04,960

the star

839
00:30:11,029 --> 00:30:08,640
face

840
00:30:13,029 --> 00:30:11,039
is like venus around the sun seen from

841
00:30:16,310 --> 00:30:13,039
us venus as a face

842
00:30:17,990 --> 00:30:16,320
so the exoplanets going around the sun

843
00:30:19,909 --> 00:30:18,000
around the other star actually

844
00:30:22,230 --> 00:30:19,919
introduces a modulation in the light

845
00:30:24,389 --> 00:30:22,240
curve together with the eclipses the

846
00:30:26,310 --> 00:30:24,399
primary and the secondary when it goes

847
00:30:29,510 --> 00:30:26,320
on the back and in front

848
00:30:32,789 --> 00:30:29,520
the exoplanet has uh the capability of

849
00:30:35,830 --> 00:30:32,799
modulate the the light curve of the star

850
00:30:37,590 --> 00:30:35,840
i'm talking about big exoplanets and

851
00:30:40,950 --> 00:30:37,600
very close to the star so it's like a

852
00:30:44,230 --> 00:30:40,960
giant moon going around but we see this

853
00:30:46,310 --> 00:30:44,240
this is uh and actually seeing these

854
00:30:48,710 --> 00:30:46,320
different wavelengths in the infrared

855
00:30:52,070 --> 00:30:48,720
the formidable

856
00:30:53,750 --> 00:30:52,080
diagnostic power about for example the

857
00:30:55,510 --> 00:30:53,760
uh the the the

858
00:30:57,510 --> 00:30:55,520
what

859
00:30:59,430 --> 00:30:57,520
how much light the planet is reflecting

860
00:31:00,710 --> 00:30:59,440
because if you study this modulation of

861
00:31:03,190 --> 00:31:00,720
the light and you think there is a

862
00:31:05,750 --> 00:31:03,200
planet showing me a face

863
00:31:08,389 --> 00:31:05,760

then you try to model say can really a

864
00:31:10,070 --> 00:31:08,399
simple white screen do this no actually

865
00:31:11,190 --> 00:31:10,080
the planet must have a sort of a

866
00:31:13,510 --> 00:31:11,200
structure

867
00:31:16,149 --> 00:31:13,520
and they basically i'm telling you they

868
00:31:18,470 --> 00:31:16,159
they start to model the weather around

869
00:31:21,590 --> 00:31:18,480
the exoplanets just studying how these

870
00:31:23,190 --> 00:31:21,600
curves oscillate in time more clouds

871
00:31:23,990 --> 00:31:23,200
less clouds

872
00:31:29,590 --> 00:31:24,000
uh

873
00:31:38,710 --> 00:31:30,630
it's a

874
00:31:42,870 --> 00:31:40,630
yeah there was a there was a space fan

875
00:31:45,590 --> 00:31:42,880
news story i did a couple of weeks ago

876
00:31:47,590 --> 00:31:45,600
where they had mapped the clouds of one

877
00:31:50,230 --> 00:31:47,600
of the exoplanets one they had found

878
00:31:52,149 --> 00:31:50,240
that one side had uh had more clouds on

879
00:31:53,830 --> 00:31:52,159
it than another and you know so you're

880
00:31:55,269 --> 00:31:53,840
right they are starting to get weather

881
00:31:57,350 --> 00:31:55,279
information from these things too

882
00:31:58,950 --> 00:31:57,360
exactly which is phenomenal to think

883
00:32:01,590 --> 00:31:58,960
about i mean

884
00:32:02,310 --> 00:32:01,600
we're looking at weather on exoplanets i

885
00:32:03,110 --> 00:32:02,320
mean

886
00:32:04,630 --> 00:32:03,120
well

887
00:32:07,990 --> 00:32:04,640
there's more clouds on one side than

888
00:32:10,149 --> 00:32:08,000

another it's hardly weather but i guess

889
00:32:11,830 --> 00:32:10,159
from a point to where we couldn't really

890
00:32:14,710 --> 00:32:11,840
even know

891
00:32:16,470 --> 00:32:14,720
any sort of atmospheric information on

892
00:32:18,230 --> 00:32:16,480
the planets within our own solar system

893
00:32:20,470 --> 00:32:18,240
to any great detail but now we're seeing

894
00:32:22,470 --> 00:32:20,480
things on things like light years away

895
00:32:24,389 --> 00:32:22,480
from us that's amazing

896
00:32:26,950 --> 00:32:24,399
what we're able to do now i mean you

897
00:32:29,029 --> 00:32:26,960
start seeing mercator projection the the

898
00:32:31,669 --> 00:32:29,039
overall of the of

899
00:32:32,870 --> 00:32:31,679
of the surface of the planet mm-hmm

900
00:32:34,230 --> 00:32:32,880
it's it's

901
00:32:36,389 --> 00:32:34,240
it's incredible

902
00:32:38,950 --> 00:32:36,399
and the stuff like like uh like what

903
00:32:41,190 --> 00:32:38,960
michael's able to do from his backyard

904
00:32:42,389 --> 00:32:41,200
you imagine a hundred years ago you just

905
00:32:44,310 --> 00:32:42,399
walked in with

906
00:32:46,230 --> 00:32:44,320
with your 14-inch michael if you just

907
00:32:49,750 --> 00:32:46,240
walked out hey look what i can do with

908
00:32:51,269 --> 00:32:49,760
my ccd and my my tracking you'd be a

909
00:32:53,190 --> 00:32:51,279
wizard right so

910
00:32:54,830 --> 00:32:53,200
it's too big i have to use wheels but i

911
00:32:57,430 --> 00:32:54,840
don't want that

912
00:32:59,669 --> 00:32:57,440
yeah you need you need what we call

913
00:33:02,870 --> 00:32:59,679

signal to noise you need right is it

914
00:33:04,470 --> 00:33:02,880
photometry so space and this is not the

915
00:33:06,789 --> 00:33:04,480
the size of the telescope it's really

916
00:33:10,149 --> 00:33:06,799
the fact that the atmosphere

917
00:33:11,750 --> 00:33:10,159
has to be a problem at some point so i'm

918
00:33:13,909 --> 00:33:11,760
about uh

919
00:33:15,830 --> 00:33:13,919
special special observations either with

920
00:33:19,350 --> 00:33:15,840
spitzer typically

921
00:33:21,669 --> 00:33:19,360
in in hubble as well but uh

922
00:33:23,430 --> 00:33:21,679
so maybe i don't know you know in 20

923
00:33:25,590 --> 00:33:23,440
years would be possible because because

924
00:33:27,029 --> 00:33:25,600
the technology for for for the ground

925
00:33:28,470 --> 00:33:27,039
they always

926
00:33:29,830 --> 00:33:28,480
lacks a little bit behind but they're

927
00:33:31,990 --> 00:33:29,840
catching up

928
00:33:33,590 --> 00:33:32,000
but just finding where to look at with

929
00:33:35,669 --> 00:33:33,600
this big beast

930
00:33:37,110 --> 00:33:35,679
would be could be

931
00:33:38,789 --> 00:33:37,120
when you're when you're saying maximum

932
00:33:40,630 --> 00:33:38,799
with the with the ground are you talking

933
00:33:42,549 --> 00:33:40,640
about the adaptive optics that are able

934
00:33:45,830 --> 00:33:42,559
to adjust for the atmospheric

935
00:33:48,950 --> 00:33:45,840
perturbations or

936
00:33:50,789 --> 00:33:48,960
you know i'm not an expert and

937
00:33:53,830 --> 00:33:50,799
i'm not an expert in the sense that this

938
00:33:56,149 --> 00:33:53,840

is a hot point right adaptive optics

939
00:33:57,110 --> 00:33:56,159
do a monster job

940
00:34:00,149 --> 00:33:57,120
for

941
00:34:02,630 --> 00:34:00,159
create beautiful images

942
00:34:04,549 --> 00:34:02,640
very crisp in the infrared right

943
00:34:06,549 --> 00:34:04,559
particular

944
00:34:09,829 --> 00:34:06,559
they have harder time

945
00:34:10,710 --> 00:34:09,839
to how to say preserve the flux

946
00:34:12,629 --> 00:34:10,720
uh

947
00:34:16,069 --> 00:34:12,639
some because you measure the flux within

948
00:34:18,069 --> 00:34:16,079
a certain area three pixels and you know

949
00:34:20,069 --> 00:34:18,079
you return and yeah the atmosphere

950
00:34:22,230 --> 00:34:20,079
changes the antioptics can put in three

951
00:34:23,909 --> 00:34:22,240
pixels sixty percent of the light

952
00:34:27,510 --> 00:34:23,919
seventy percent of the light fifty

953
00:34:28,470 --> 00:34:27,520
percent twenty twenty to ninety whatever

954
00:34:30,710 --> 00:34:28,480
they

955
00:34:32,869 --> 00:34:30,720
that the office does the best but is

956
00:34:34,950 --> 00:34:32,879
hardly consistent because it's fighting

957
00:34:37,589 --> 00:34:34,960
against the variability of atmosphere so

958
00:34:41,030 --> 00:34:37,599
if you get within your your major

959
00:34:43,430 --> 00:34:41,040
field a different amount of light every

960
00:34:45,349 --> 00:34:43,440
minute or every second

961
00:34:47,750 --> 00:34:45,359
it's very hard to get the signal which

962
00:34:48,790 --> 00:34:47,760
is flat and see little dense you will

963
00:34:51,109 --> 00:34:48,800

always get

964
00:34:53,349 --> 00:34:51,119
noise right absolutely not this will

965
00:34:54,869 --> 00:34:53,359
always give you something that looks

966
00:34:57,349 --> 00:34:54,879
very sharp

967
00:35:00,150 --> 00:34:57,359
even better than hubble

968
00:35:02,870 --> 00:35:00,160
but if you redo it will look very sharp

969
00:35:05,430 --> 00:35:02,880
but not exactly the same right right and

970
00:35:07,270 --> 00:35:05,440
for these type of measures

971
00:35:08,630 --> 00:35:07,280
you want consistency

972
00:35:10,630 --> 00:35:08,640
absolutely one of the one of the things

973
00:35:11,910 --> 00:35:10,640
i do i don't have any adaptive optics

974
00:35:13,510 --> 00:35:11,920
i'll say that first but one of the

975
00:35:15,349 --> 00:35:13,520
things that i do

976
00:35:17,510 --> 00:35:15,359
to take pictures of planets to steady

977
00:35:19,910 --> 00:35:17,520
the seeing is is this concept of lucky

978
00:35:21,990 --> 00:35:19,920
imaging where you take you know as many

979
00:35:24,390 --> 00:35:22,000
frames as you can and you you average

980
00:35:25,910 --> 00:35:24,400
them all out which tends to reduce a lot

981
00:35:28,150 --> 00:35:25,920
of the variability while it's not a

982
00:35:29,750 --> 00:35:28,160
complete picture like you're saying it

983
00:35:31,190 --> 00:35:29,760
does tend to flatten out some of those

984
00:35:33,349 --> 00:35:31,200
peaks and valleys so you end up with an

985
00:35:35,270 --> 00:35:33,359
average of you know 55.2 percent and

986
00:35:37,910 --> 00:35:35,280
it's a measurable thing and it's and it

987
00:35:40,310 --> 00:35:37,920
tends to be that uh specific pixel you

988
00:35:41,829 --> 00:35:40,320

know coordinate let's say absolutely of

989
00:35:43,349 --> 00:35:41,839
course you eat your signal to noise

990
00:35:45,910 --> 00:35:43,359
because you spend one minute and you

991
00:35:46,870 --> 00:35:45,920
have one one second of exposure if you

992
00:35:47,589 --> 00:35:46,880
do

993
00:35:49,910 --> 00:35:47,599
right

994
00:35:52,230 --> 00:35:49,920
so it's a it's it's always a trade-off i

995
00:35:53,670 --> 00:35:52,240
tell you like space it's hard i mean

996
00:35:55,270 --> 00:35:53,680
there is nothing like the hubble at the

997
00:35:57,910 --> 00:35:55,280
moment

998
00:35:59,430 --> 00:35:57,920
for this type of precision for this type

999
00:36:02,150 --> 00:35:59,440
of work

1000
00:36:03,910 --> 00:36:02,160
so let me ask you this then massimo uh

1001
00:36:05,270 --> 00:36:03,920
what about the uh the james webb space

1002
00:36:07,910 --> 00:36:05,280
telescope are you ready it's just about

1003
00:36:10,390 --> 00:36:07,920
to ask that you beat me to it tony oh

1004
00:36:12,710 --> 00:36:10,400
well that's my gratuitous yeah i wanna i

1005
00:36:14,150 --> 00:36:12,720
wanted to see um

1006
00:36:17,030 --> 00:36:14,160
do you anticipate your research getting

1007
00:36:20,150 --> 00:36:17,040
better with with web so web is hubble on

1008
00:36:21,990 --> 00:36:20,160
steroids yes

1009
00:36:24,870 --> 00:36:22,000
so we're going to put an asterisk next

1010
00:36:26,630 --> 00:36:24,880
to everything or

1011
00:36:29,430 --> 00:36:26,640
the only problem with the web is

1012
00:36:31,829 --> 00:36:29,440
infrared and i say is a problem because

1013
00:36:33,589 --> 00:36:31,839

it will open a new window

1014
00:36:36,069 --> 00:36:33,599
but we are going to lose another one we

1015
00:36:37,589 --> 00:36:36,079
are going to lose the the uv the optical

1016
00:36:39,589 --> 00:36:37,599
so

1017
00:36:41,270 --> 00:36:39,599
it's a as as i say now i was saying

1018
00:36:43,270 --> 00:36:41,280
before we see that the variability in

1019
00:36:45,190 --> 00:36:43,280
the infrared not always correlate with

1020
00:36:46,870 --> 00:36:45,200
the one in the visible

1021
00:36:48,950 --> 00:36:46,880
you would like to have both

1022
00:36:51,190 --> 00:36:48,960
right right always

1023
00:36:53,030 --> 00:36:51,200
and and we may be lucky to have hubble

1024
00:36:55,030 --> 00:36:53,040
and web

1025
00:36:56,230 --> 00:36:55,040
together for a few years that's that's

1026
00:36:58,870 --> 00:36:56,240
what we hope

1027
00:37:01,589 --> 00:36:58,880
especially if web is stays on schedule

1028
00:37:03,109 --> 00:37:01,599
as as we hope if they don't you know if

1029
00:37:06,550 --> 00:37:03,119
the the the

1030
00:37:11,349 --> 00:37:06,560
dc they don't do anything strange

1031
00:37:13,990 --> 00:37:11,359
as we do uh but uh but um

1032
00:37:16,870 --> 00:37:14,000
web is is infrared

1033
00:37:18,230 --> 00:37:16,880
so we need to hope that hubble will stay

1034
00:37:19,270 --> 00:37:18,240
there

1035
00:37:20,710 --> 00:37:19,280
well

1036
00:37:22,470 --> 00:37:20,720
i guess we'll i guess we'll look forward

1037
00:37:24,310 --> 00:37:22,480
to seeing what that what it can add at

1038
00:37:25,670 --> 00:37:24,320

least um any other things you'd like to

1039
00:37:27,030 --> 00:37:25,680
bring you bring to our attention today

1040
00:37:28,230 --> 00:37:27,040
that you that struck you with the

1041
00:37:29,589 --> 00:37:28,240
workshop

1042
00:37:31,030 --> 00:37:29,599
um

1043
00:37:32,710 --> 00:37:31,040
let me think

1044
00:37:34,230 --> 00:37:32,720
uh

1045
00:37:35,670 --> 00:37:34,240
this is i think this was basically at

1046
00:37:38,069 --> 00:37:35,680
the moment this is the point that i

1047
00:37:40,470 --> 00:37:38,079
remember i'm tired i mean i can

1048
00:37:43,109 --> 00:37:40,480
trigger me everything comes up but uh

1049
00:37:44,310 --> 00:37:43,119
what okay well uh massive i don't want

1050
00:37:45,910 --> 00:37:44,320
to take up more of your time i know

1051
00:37:47,270 --> 00:37:45,920
you're busy and you too you're gracious

1052
00:37:49,270 --> 00:37:47,280
enough to take time out to talk to us

1053
00:37:50,790 --> 00:37:49,280
about this stuff uh this was awesome

1054
00:37:53,510 --> 00:37:50,800
this was really great it sounds like you

1055
00:37:56,390 --> 00:37:53,520
really had a great meeting today and um

1056
00:37:57,750 --> 00:37:56,400
i'm hoping that uh maybe we could get

1057
00:37:59,190 --> 00:37:57,760
together again sometime in the near

1058
00:38:00,150 --> 00:37:59,200
future and we'll sort of follow up on

1059
00:38:02,069 --> 00:38:00,160
some of the things that we talked about

1060
00:38:03,910 --> 00:38:02,079
absolutely let me remind that if you go

1061
00:38:05,670 --> 00:38:03,920
to the web space to the website of the

1062
00:38:08,069 --> 00:38:05,680
space telescope science institute you

1063
00:38:10,790 --> 00:38:08,079

easily find the link to the conference

1064
00:38:13,750 --> 00:38:10,800
if you go to the open the page you find

1065
00:38:15,670 --> 00:38:13,760
the webcast which means that first

1066
00:38:17,829 --> 00:38:15,680
tomorrow you can still follow the

1067
00:38:20,230 --> 00:38:17,839
conference and in the future everything

1068
00:38:22,710 --> 00:38:20,240
is archived you can click on the token

1069
00:38:25,829 --> 00:38:22,720
variability for example and here the

1070
00:38:27,910 --> 00:38:25,839
real stuff not my my easy you know chat

1071
00:38:29,430 --> 00:38:27,920
here but you can get the talk you like

1072
00:38:31,030 --> 00:38:29,440
your easy job

1073
00:38:33,670 --> 00:38:31,040
and get those and correct me because

1074
00:38:35,190 --> 00:38:33,680
probably i i miss something

1075
00:38:36,950 --> 00:38:35,200
well no that's a great point i'm glad

1076
00:38:40,630 --> 00:38:36,960
you brought that up i have put a link to

1077
00:38:42,870 --> 00:38:40,640
the to the uh event to the workshop on

1078
00:38:45,030 --> 00:38:42,880
this event page so you can go there and

1079
00:38:46,790 --> 00:38:45,040
follow along all the talks are posted

1080
00:38:49,109 --> 00:38:46,800
and you can watch them yourself and and

1081
00:38:51,270 --> 00:38:49,119
make your own comments so uh or make get

1082
00:38:52,870 --> 00:38:51,280
the information firsthand so massimo

1083
00:38:54,870 --> 00:38:52,880
you're welcome to stay i thank you so

1084
00:38:56,390 --> 00:38:54,880
much for joining us i think we're just

1085
00:38:58,630 --> 00:38:56,400
gonna kind of chat a little bit and kind

1086
00:39:00,069 --> 00:38:58,640
of take some comments i don't see a

1087
00:39:00,950 --> 00:39:00,079
whole lot of questions did you see any

1088
00:39:02,390 --> 00:39:00,960

scott

1089
00:39:04,550 --> 00:39:02,400
i'm looking into them right now i'm not

1090
00:39:05,990 --> 00:39:04,560
seeing a ton we did hit a lot yesterday

1091
00:39:07,430 --> 00:39:06,000
but i know we missed a couple yesterday

1092
00:39:09,349 --> 00:39:07,440
so i'm trying to pull those up okay so

1093
00:39:10,950 --> 00:39:09,359
while we still have massimo maybe we'll

1094
00:39:12,950 --> 00:39:10,960
we'll see what we got here yeah don't go

1095
00:39:14,710 --> 00:39:12,960
anywhere massimo okay

1096
00:39:16,870 --> 00:39:14,720
you and your haircut is just looking too

1097
00:39:19,750 --> 00:39:16,880
good we need to stay in the same hangout

1098
00:39:21,910 --> 00:39:19,760
actually i got i i got a guest here so

1099
00:39:24,790 --> 00:39:21,920
if you haven't nicola

1100
00:39:27,750 --> 00:39:24,800
which is here is uh the leading expert

1101
00:39:29,670 --> 00:39:27,760
today of the stars in the nebula

1102
00:39:33,829 --> 00:39:29,680
nebula cluster he has done the best

1103
00:39:35,510 --> 00:39:33,839
measures knows everything really so

1104
00:39:37,190 --> 00:39:35,520
so what's your i'm sorry i think i

1105
00:39:40,150 --> 00:39:37,200
missed your name what's your name

1106
00:39:42,390 --> 00:39:40,160
nicola dario is italian was my student

1107
00:39:43,430 --> 00:39:42,400
here actually now is university of

1108
00:39:45,349 --> 00:39:43,440
florida

1109
00:39:47,270 --> 00:39:45,359
awesome so what are you so what are you

1110
00:39:48,790 --> 00:39:47,280
thinking about what the the workshop

1111
00:39:51,030 --> 00:39:48,800
today what what are your insights did

1112
00:39:54,069 --> 00:39:51,040
you uh was there anything stuck out in

1113
00:39:56,310 --> 00:39:54,079

your mind today today i i think the uh

1114
00:39:58,390 --> 00:39:56,320
the major point that i liked about the

1115
00:40:00,870 --> 00:39:58,400
the workshop was this extension you know

1116
00:40:03,030 --> 00:40:00,880
from the smaller or iron nebula cluster

1117
00:40:05,349 --> 00:40:03,040
to a larger complex you know ion that

1118
00:40:07,589 --> 00:40:05,359
could also the different populations of

1119
00:40:08,870 --> 00:40:07,599
different ages with different properties

1120
00:40:11,430 --> 00:40:08,880
and we we

1121
00:40:13,589 --> 00:40:11,440
heard quite a lot of talks about this

1122
00:40:15,990 --> 00:40:13,599
you know explored at all wavelengths

1123
00:40:18,950 --> 00:40:16,000
investigating the properties of this

1124
00:40:19,910 --> 00:40:18,960
complex in the in the larger scale in

1125
00:40:21,030 --> 00:40:19,920
the

1126
00:40:23,190 --> 00:40:21,040
um

1127
00:40:25,430 --> 00:40:23,200
what's some of the properties there

1128
00:40:26,390 --> 00:40:25,440
for example the fact that

1129
00:40:28,550 --> 00:40:26,400
um

1130
00:40:30,550 --> 00:40:28,560
there were some talks focusing on the

1131
00:40:33,270 --> 00:40:30,560
fact that it seems

1132
00:40:36,550 --> 00:40:33,280
that along this region called the the

1133
00:40:39,750 --> 00:40:36,560
ionia filament that contains the the onc

1134
00:40:42,310 --> 00:40:39,760
the ion nebula cluster as a denser part

1135
00:40:45,589 --> 00:40:42,320
but the entire structure which is much

1136
00:40:48,950 --> 00:40:45,599
larger contains a loser less

1137
00:40:51,510 --> 00:40:48,960
lower density population that in total

1138
00:40:53,829 --> 00:40:51,520

since it is a large structure as a mass

1139
00:40:55,109 --> 00:40:53,839
total stellar mass comparable to that of

1140
00:40:59,910 --> 00:40:55,119
the

1141
00:41:01,349 --> 00:40:59,920
cluster and if we look in detail into

1142
00:41:03,910 --> 00:41:01,359
this population and trying to

1143
00:41:06,390 --> 00:41:03,920
distinguish sources with disks

1144
00:41:07,510 --> 00:41:06,400
associated without disks it seems that

1145
00:41:08,550 --> 00:41:07,520
they are not

1146
00:41:10,470 --> 00:41:08,560
um

1147
00:41:13,030 --> 00:41:10,480
equally distributed but there are sub

1148
00:41:16,790 --> 00:41:13,040
clusters uh with sources that appear in

1149
00:41:20,069 --> 00:41:16,800
a in an earlier stage of uh evolution

1150
00:41:22,230 --> 00:41:20,079
and others that appear slightly older so

1151
00:41:23,270 --> 00:41:22,240
probably this means that the formation

1152
00:41:27,270 --> 00:41:23,280
of this

1153
00:41:29,670 --> 00:41:27,280
um this entire region um has not been

1154
00:41:31,430 --> 00:41:29,680
like a single smooth event you know that

1155
00:41:33,829 --> 00:41:31,440
happened everywhere but

1156
00:41:36,470 --> 00:41:33,839
um it started in some places and then

1157
00:41:38,630 --> 00:41:36,480
progressed to other uh nearby regions

1158
00:41:40,230 --> 00:41:38,640
along the filament of this yes

1159
00:41:43,910 --> 00:41:40,240
surprising to you were you expecting it

1160
00:41:47,750 --> 00:41:43,920
to be more homogeneous across there

1161
00:41:50,309 --> 00:41:47,760
i was not but uh i think that uh um

1162
00:41:52,950 --> 00:41:50,319
until one year ago nobody suspected this

1163
00:41:55,430 --> 00:41:52,960

you know um uh they were when the for

1164
00:41:58,550 --> 00:41:55,440
the first time uh juan auto that gave a

1165
00:42:02,790 --> 00:41:58,560
speech today um proposed the fact that

1166
00:42:04,950 --> 00:42:02,800
uh there is a a foreground cluster um

1167
00:42:06,470 --> 00:42:04,960
which is older just south of the valley

1168
00:42:09,670 --> 00:42:06,480
nebula cluster this

1169
00:42:11,910 --> 00:42:09,680
was very controversial and today

1170
00:42:14,069 --> 00:42:11,920
several evidence several pieces of

1171
00:42:16,950 --> 00:42:14,079
evidence confirmed that

1172
00:42:18,790 --> 00:42:16,960
this this is the case and uh and it is

1173
00:42:21,750 --> 00:42:18,800
this is not uh isolated so the

1174
00:42:23,829 --> 00:42:21,760
properties of the population um change

1175
00:42:25,430 --> 00:42:23,839
along the region i'm sorry what was the

1176
00:42:26,470 --> 00:42:25,440
controversy i didn't i didn't get the

1177
00:42:28,470 --> 00:42:26,480
controversy what was coming the

1178
00:42:31,829 --> 00:42:28,480
controversy was the fact that it was

1179
00:42:34,069 --> 00:42:31,839
suggested by joao alves that just to the

1180
00:42:36,710 --> 00:42:34,079
south of the nebula cluster where there

1181
00:42:40,309 --> 00:42:39,349
there is a population of bright sources

1182
00:42:43,349 --> 00:42:40,319
uh

1183
00:42:45,349 --> 00:42:43,359
which is accompanied by loma sources and

1184
00:42:48,150 --> 00:42:45,359
it was thought to be part of the system

1185
00:42:50,630 --> 00:42:48,160
and he suggested that in fact is an

1186
00:42:52,230 --> 00:42:50,640
older cluster which is uh which is not

1187
00:42:54,710 --> 00:42:52,240
related

1188
00:42:56,870 --> 00:42:54,720

it is in front of it basically

1189
00:42:59,589 --> 00:42:56,880
we knew that in front of the orion

1190
00:43:00,470 --> 00:42:59,599
nebula there are a few stars that

1191
00:43:03,670 --> 00:43:00,480
you know

1192
00:43:06,069 --> 00:43:03,680
maybe are passing in front and do you

1193
00:43:08,550 --> 00:43:06,079
expect this because uh stars have been

1194
00:43:10,550 --> 00:43:08,560
forming and they are moving in and out

1195
00:43:12,790 --> 00:43:10,560
uh around right

1196
00:43:15,510 --> 00:43:12,800
the the new result is that actually

1197
00:43:18,870 --> 00:43:15,520
these few stars are the tail of a

1198
00:43:21,510 --> 00:43:18,880
condensation that is centered south of

1199
00:43:24,069 --> 00:43:21,520
the nebula it's older and this

1200
00:43:27,430 --> 00:43:24,079
substantial and if you move even further

1201
00:43:29,750 --> 00:43:27,440
south you see other minor condensations

1202
00:43:32,069 --> 00:43:29,760
so the entire filament because this is

1203
00:43:33,750 --> 00:43:32,079
actually a filament of star formation is

1204
00:43:36,870 --> 00:43:33,760
not a loose

1205
00:43:38,950 --> 00:43:36,880
association of stars passing by that are

1206
00:43:40,790 --> 00:43:38,960
there by chance but really sights of

1207
00:43:42,230 --> 00:43:40,800
older star formation

1208
00:43:43,270 --> 00:43:42,240
and they've been discovered this year

1209
00:43:45,030 --> 00:43:43,280
basically

1210
00:43:47,589 --> 00:43:45,040
and they are not part of the orion

1211
00:43:50,710 --> 00:43:47,599
complex then so the ion complexes as i

1212
00:43:52,870 --> 00:43:50,720
said earlier is a hot spot in this in

1213
00:43:55,270 --> 00:43:52,880

this history of events but we are

1214
00:43:57,030 --> 00:43:55,280
understanding better what's going on

1215
00:43:58,630 --> 00:43:57,040
around and actually we are thinking as

1216
00:44:01,510 --> 00:43:58,640
nicola was saying that to understand

1217
00:44:03,349 --> 00:44:01,520
orion we cannot only concentrate on

1218
00:44:05,510 --> 00:44:03,359
orion we need to basically look at the

1219
00:44:08,710 --> 00:44:05,520
big picture otherwise we miss

1220
00:44:10,630 --> 00:44:08,720
we miss why is there what is going on

1221
00:44:13,190 --> 00:44:10,640
and what triggered this this event and

1222
00:44:15,589 --> 00:44:13,200
how orion may trigger maybe new

1223
00:44:18,470 --> 00:44:15,599
generations and to clarify about your

1224
00:44:20,790 --> 00:44:18,480
question um so this this cluster just to

1225
00:44:23,750 --> 00:44:20,800
the side to the south of the nebula

1226
00:44:26,870 --> 00:44:23,760
cluster seems not to be related with the

1227
00:44:28,230 --> 00:44:26,880
with the region seems to be something uh

1228
00:44:29,829 --> 00:44:28,240
much i'd say

1229
00:44:32,309 --> 00:44:29,839
this and that's a new discovery that's

1230
00:44:33,750 --> 00:44:32,319
something that's brand new and

1231
00:44:35,510 --> 00:44:33,760
is it or is it not a part of the

1232
00:44:38,390 --> 00:44:35,520
condensation that massimo was talking

1233
00:44:41,109 --> 00:44:38,400
about i uh it seems to me things

1234
00:44:44,309 --> 00:44:41,119
not part of the of this filament the

1235
00:44:47,270 --> 00:44:44,319
ionization filament per se is part of

1236
00:44:49,430 --> 00:44:47,280
the much larger structure that includes

1237
00:44:51,270 --> 00:44:49,440
basically the entire

1238
00:44:52,069 --> 00:44:51,280

constellation of orion where we also

1239
00:44:54,710 --> 00:44:52,079
have

1240
00:44:57,109 --> 00:44:54,720
all the uh populations

1241
00:44:58,710 --> 00:44:57,119
okay so the the what massimo was talking

1242
00:45:01,190 --> 00:44:58,720
about was part of the bigger picture the

1243
00:45:02,550 --> 00:45:01,200
larger structure of the orion complex

1244
00:45:04,230 --> 00:45:02,560
what you're saying

1245
00:45:06,069 --> 00:45:04,240
is that there's a southern southern

1246
00:45:08,309 --> 00:45:06,079
cluster of stars that

1247
00:45:10,230 --> 00:45:08,319
were not part of the orion nebula but at

1248
00:45:11,910 --> 00:45:10,240
our part of this larger structure

1249
00:45:13,109 --> 00:45:11,920
exactly and and

1250
00:45:14,069 --> 00:45:13,119
no thank you

1251
00:45:16,550 --> 00:45:14,079
okay

1252
00:45:18,790 --> 00:45:16,560
trouble getting it all sorted out

1253
00:45:20,550 --> 00:45:18,800
because i wasn't excuse me i wasn't sure

1254
00:45:23,589 --> 00:45:20,560
which one we were you know the nebula

1255
00:45:25,589 --> 00:45:23,599
versus the compound and uh for us if you

1256
00:45:27,910 --> 00:45:25,599
talking about the orion nebula cluster

1257
00:45:30,470 --> 00:45:27,920
which is the main topic

1258
00:45:32,470 --> 00:45:30,480
this is interesting also because of the

1259
00:45:35,910 --> 00:45:32,480
contamination because if we want to

1260
00:45:38,710 --> 00:45:35,920
study the properties of 1000 stars and

1261
00:45:41,670 --> 00:45:38,720
and see what's the main age the you know

1262
00:45:44,950 --> 00:45:41,680
the all the statistical uh numbers that

1263
00:45:47,270 --> 00:45:44,960

we get to to have a feeling of what

1264
00:45:49,270 --> 00:45:47,280
the round numbers first

1265
00:45:51,589 --> 00:45:49,280
all these all these stars that do not

1266
00:45:53,750 --> 00:45:51,599
belong are confusing

1267
00:45:55,430 --> 00:45:53,760
and one of the problems for us is to to

1268
00:45:57,030 --> 00:45:55,440
understand which is which to whom they

1269
00:45:58,150 --> 00:45:57,040
belong

1270
00:45:59,990 --> 00:45:58,160
okay

1271
00:46:01,589 --> 00:46:00,000
i would try to pronounce your name again

1272
00:46:03,910 --> 00:46:01,599
but i know i'd mess it up but i want to

1273
00:46:05,430 --> 00:46:03,920
ask you a question you look like you're

1274
00:46:07,109 --> 00:46:05,440
pretty young like you're just getting

1275
00:46:09,030 --> 00:46:07,119
started out there in your career am i

1276
00:46:11,750 --> 00:46:09,040
right or have you been around a while

1277
00:46:14,630 --> 00:46:11,760
well i finished my my phd a few years

1278
00:46:16,870 --> 00:46:14,640
ago two years ago and uh

1279
00:46:18,470 --> 00:46:16,880
i'm a young scientist yes so good i'd

1280
00:46:21,030 --> 00:46:18,480
like to ask you a question then i i'd

1281
00:46:22,950 --> 00:46:21,040
like you to do you have any advice for

1282
00:46:25,750 --> 00:46:22,960
people who are just now starting to

1283
00:46:26,870 --> 00:46:25,760
embark on their graduate careers or

1284
00:46:28,309 --> 00:46:26,880
they're thinking about becoming an

1285
00:46:30,950 --> 00:46:28,319
astronomer do you have any advice for

1286
00:46:32,950 --> 00:46:30,960
those guys and what would you say

1287
00:46:34,710 --> 00:46:32,960
surprised you the most that you didn't

1288
00:46:36,230 --> 00:46:34,720

expect as you progressed into your

1289
00:46:37,829 --> 00:46:36,240
career

1290
00:46:42,630 --> 00:46:37,839
um

1291
00:46:44,710 --> 00:46:42,640
you know some advices are pretty

1292
00:46:47,270 --> 00:46:44,720
standard i would say you know even the

1293
00:46:49,190 --> 00:46:47,280
choice of the of the field of stuff

1294
00:46:50,950 --> 00:46:49,200
research is important you know not all

1295
00:46:51,990 --> 00:46:50,960
the fields of research can lead to a

1296
00:46:53,109 --> 00:46:52,000
career

1297
00:47:00,390 --> 00:46:53,119
and

1298
00:47:03,349 --> 00:47:00,400
if i have to say one thing that really

1299
00:47:05,190 --> 00:47:03,359
struck me the most is the fact that uh

1300
00:47:06,069 --> 00:47:05,200
you know during the graduate

1301
00:47:08,309 --> 00:47:06,079
years

1302
00:47:10,790 --> 00:47:08,319
sometimes it can be stressful it can be

1303
00:47:13,829 --> 00:47:10,800
frustrating uh when the you know young

1304
00:47:16,550 --> 00:47:13,839
research has just started and start work

1305
00:47:19,510 --> 00:47:16,560
and that things don't work out you know

1306
00:47:24,550 --> 00:47:19,520
but later on you know this um this

1307
00:47:25,670 --> 00:47:24,560
effort is is uh paid off i would say um

1308
00:47:28,230 --> 00:47:25,680
are you saying it's just a little

1309
00:47:30,950 --> 00:47:28,240
stressful i've heard different

1310
00:47:33,270 --> 00:47:30,960
i think it's a little more

1311
00:47:35,109 --> 00:47:33,280
from the grad students and postdocs i

1312
00:47:37,030 --> 00:47:35,119
know it's a little more than than that

1313
00:47:39,589 --> 00:47:37,040

but i think it also you have a really

1314
00:47:42,069 --> 00:47:39,599
good team and support structure that you

1315
00:47:44,390 --> 00:47:42,079
can go to for that is that right

1316
00:47:46,150 --> 00:47:44,400
yes that's fundamental as well

1317
00:47:48,630 --> 00:47:46,160
so massimo what would you say to that

1318
00:47:50,470 --> 00:47:48,640
question what i mean how how what advice

1319
00:47:51,670 --> 00:47:50,480
would you give to prospective phd

1320
00:47:53,510 --> 00:47:51,680
students students thinking about getting

1321
00:47:55,109 --> 00:47:53,520
into astronomy

1322
00:47:58,069 --> 00:47:55,119
follow your dream

1323
00:47:59,430 --> 00:47:58,079
which is what i did and i i

1324
00:48:04,390 --> 00:47:59,440
i

1325
00:48:06,470 --> 00:48:04,400
harvard or caltech

1326
00:48:09,109 --> 00:48:06,480
i i started my career in a small

1327
00:48:11,510 --> 00:48:09,119
observatory i was

1328
00:48:13,750 --> 00:48:11,520
enthusiastic i was in love with this job

1329
00:48:15,030 --> 00:48:13,760
i was curious

1330
00:48:17,510 --> 00:48:15,040
uh

1331
00:48:18,589 --> 00:48:17,520
and you still are now right

1332
00:48:30,470 --> 00:48:18,599
i

1333
00:48:32,710 --> 00:48:30,480
someone asked me

1334
00:48:35,030 --> 00:48:32,720
what do you want really to know know

1335
00:48:37,270 --> 00:48:35,040
what is you know not just write another

1336
00:48:39,270 --> 00:48:37,280
paper or but what is the question that

1337
00:48:40,950 --> 00:48:39,280
really will keep you up

1338
00:48:43,670 --> 00:48:40,960

in the night that you know where your

1339
00:48:46,950 --> 00:48:43,680
curiosity what is the big the big

1340
00:48:49,190 --> 00:48:46,960
this is if you feel this this push if

1341
00:48:50,950 --> 00:48:49,200
you feel this this type of curiosity

1342
00:48:52,950 --> 00:48:50,960
this is your job

1343
00:48:54,790 --> 00:48:52,960
otherwise you go you make more money

1344
00:48:56,470 --> 00:48:54,800
elsewhere i tell you if you are if you

1345
00:48:58,549 --> 00:48:56,480
are you know us we are intelligent and

1346
00:49:01,190 --> 00:48:58,559
bright etc but if you have this

1347
00:49:03,750 --> 00:49:01,200
curiosity for nature for for for a

1348
00:49:05,349 --> 00:49:03,760
reality if you if you keep you know if

1349
00:49:08,309 --> 00:49:05,359
you can be amazed

1350
00:49:11,109 --> 00:49:08,319
and and and asking always the new and

1351
00:49:13,030 --> 00:49:11,119
better question as we try

1352
00:49:14,470 --> 00:49:13,040
doing that that's absolutely right i

1353
00:49:16,069 --> 00:49:14,480
mean everyone i've come across you see

1354
00:49:17,670 --> 00:49:16,079
some people just get burnt out by it

1355
00:49:19,349 --> 00:49:17,680
they don't have that that passion

1356
00:49:21,270 --> 00:49:19,359
anymore because somewhere along the line

1357
00:49:23,670 --> 00:49:21,280
it's just falling off but when you're

1358
00:49:25,990 --> 00:49:23,680
able to maintain that curiosity to find

1359
00:49:27,510 --> 00:49:26,000
out more about the natural world and

1360
00:49:28,870 --> 00:49:27,520
it's something that keeps driving you

1361
00:49:30,390 --> 00:49:28,880
and driving you that's

1362
00:49:32,630 --> 00:49:30,400
you know no matter what you're doing

1363
00:49:34,950 --> 00:49:32,640

especially in science that's what that's

1364
00:49:36,230 --> 00:49:34,960
what you do is you're trying to discover

1365
00:49:37,910 --> 00:49:36,240
and explore what you didn't know

1366
00:49:39,349 --> 00:49:37,920
yesterday and solve those problems that

1367
00:49:41,190 --> 00:49:39,359
keep you up at night

1368
00:49:42,150 --> 00:49:41,200
so if we're able to

1369
00:49:44,069 --> 00:49:42,160
to

1370
00:49:45,270 --> 00:49:44,079
keep that maintain that and support

1371
00:49:47,109 --> 00:49:45,280
those that

1372
00:49:49,270 --> 00:49:47,119
feel that i think that's really

1373
00:49:51,829 --> 00:49:49,280
important right now and a lot of that's

1374
00:49:53,829 --> 00:49:51,839
being lost there's a lot of frustrations

1375
00:49:56,549 --> 00:49:53,839
going on especially here in this country

1376
00:49:58,950 --> 00:49:56,559
with science but if we're able to take

1377
00:50:01,270 --> 00:49:58,960
those people that are motivated and that

1378
00:50:03,589 --> 00:50:01,280
want to keep their passion alive with

1379
00:50:05,589 --> 00:50:03,599
that we really need to help them foster

1380
00:50:07,510 --> 00:50:05,599
and support them through those times

1381
00:50:09,589 --> 00:50:07,520
it's a lot of fun it's the best job of

1382
00:50:11,430 --> 00:50:09,599
the world

1383
00:50:13,990 --> 00:50:11,440
go for it if you like it

1384
00:50:15,750 --> 00:50:14,000
all right i think on that note that is a

1385
00:50:18,630 --> 00:50:15,760
perfect note with which to end this

1386
00:50:20,630 --> 00:50:18,640
broadcast uh we're out of time um i

1387
00:50:22,630 --> 00:50:20,640
would like to thank uh

1388
00:50:24,069 --> 00:50:22,640

dr massimo roberto thank you very much

1389
00:50:26,069 --> 00:50:24,079
for joining us tonight this has been a

1390
00:50:27,829 --> 00:50:26,079
lot of fun and can you please say your

1391
00:50:30,549 --> 00:50:27,839
student's name one more time please

1392
00:50:32,390 --> 00:50:30,559
don't mess it up nicola

1393
00:50:34,870 --> 00:50:32,400
nicolas

1394
00:50:36,790 --> 00:50:34,880
nicola thank you i'm a visual person

1395
00:50:39,190 --> 00:50:36,800
that helps me thank you

1396
00:50:41,270 --> 00:50:39,200
nicola that's exactly what i needed uh

1397
00:50:42,870 --> 00:50:41,280
thank you also for for joining us uh

1398
00:50:45,270 --> 00:50:42,880
michael phillips thank you for joining

1399
00:50:46,790 --> 00:50:45,280
and uh ian thank you i love i love

1400
00:50:48,630 --> 00:50:46,800
having a chance to work with you i hope

1401
00:50:50,309 --> 00:50:48,640
to do more of this kind of thing thank

1402
00:50:52,549 --> 00:50:50,319
you tony no i'll be back this is very

1403
00:50:55,190 --> 00:50:52,559
cool oh good i i'll be definitely

1404
00:50:57,190 --> 00:50:55,200
inviting you back and uh so that's it

1405
00:50:59,510 --> 00:50:57,200
for this time space fan space fans

1406
00:51:01,190 --> 00:50:59,520
facebook huggers

1407
00:51:06,230 --> 00:51:01,200
that's friday