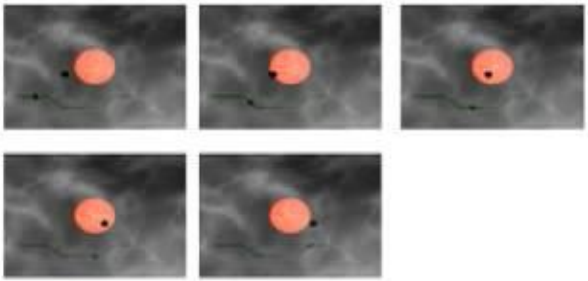
UCL

SPITZER OBSERVATIONS



4.5 hours on October 31, 2006 at 3.6 and 5.8 μm (Beaulieu et al., ApJ,2007)
33 hours on November 2, 8 μm (Knutson et al., 2007, Nature)

1
00:00:08,390 --> 00:00:04,269
well good morning or afternoon everyone

2
00:00:10,790 --> 00:00:08,400
welcome to the nai director seminar for

3
00:00:13,669 --> 00:00:10,800
this month I am really really pleased

4
00:00:16,700 --> 00:00:13,679
that Giovanna tinetti is here she's

5
00:00:19,429 --> 00:00:16,710
actually here with us in the video

6
00:00:22,340 --> 00:00:19,439
conference room at nai central I think

7
00:00:24,800 --> 00:00:22,350
all of you know that the second bullet

8
00:00:26,929 --> 00:00:24,810
in na eyes mission statement is to train

9
00:00:30,259 --> 00:00:26,939
the next generation of astrobiologists

10
00:00:33,799 --> 00:00:30,269
and Giovanna to Nettie has got to be our

11
00:00:37,520 --> 00:00:33,809
poster child so to speak in that regard

12
00:00:41,060 --> 00:00:37,530
Giovanna was a particle physicist at the

13
00:00:43,880 --> 00:00:41,070

University of Torino she got her

14
00:00:46,940 --> 00:00:43,890
bachelor's degree in particle physics at

15
00:00:49,720 --> 00:00:46,950
Torino and learned about all this

16
00:00:52,520 --> 00:00:49,730
wonderful stuff that was going on in

17
00:00:56,900 --> 00:00:52,530
understanding habitable environments on

18
00:00:58,700 --> 00:00:56,910
other planets and in understanding the

19
00:01:02,750 --> 00:00:58,710
nature of life on Earth and bringing all

20
00:01:06,010 --> 00:01:02,760
of these fields together she did a PhD

21
00:01:08,060 --> 00:01:06,020
at the University of Torino in the

22
00:01:10,120 --> 00:01:08,070
department of physics but her thesis

23
00:01:14,950 --> 00:01:10,130
title was energy and entropy for

24
00:01:20,060 --> 00:01:14,960
extraterrestrial life and she contacted

25
00:01:23,539 --> 00:01:20,070
Ken Nealson who was one of our new pie's

26
00:01:27,710 --> 00:01:23,549
as well as a couple of our other new

27
00:01:29,870 --> 00:01:27,720
pie's around year 2000 and wound up

28
00:01:32,330 --> 00:01:29,880
coming over in joining Ken Nielsen's

29
00:01:35,600 --> 00:01:32,340
team and then joining Vicky Meadows team

30
00:01:38,990 --> 00:01:35,610
when vpl was selected to join the

31
00:01:41,410 --> 00:01:39,000
Institute in can too and I think all we

32
00:01:44,530 --> 00:01:41,420
can say is that the rest is history

33
00:01:48,490 --> 00:01:44,540
Giovanna has since been making headlines

34
00:01:51,350 --> 00:01:48,500
with some of her work on observations of

35
00:01:55,149 --> 00:01:51,360
extrasolar planets particularly using

36
00:01:58,550 --> 00:01:55,159
the Spitzer Space Telescope and she was

37
00:02:01,870 --> 00:01:58,560
chosen the best young Italian physicist

38
00:02:05,929 --> 00:02:01,880

in the in the entire nation one award in

39
00:02:09,020 --> 00:02:05,939
1999 and is now a researcher at

40
00:02:10,850 --> 00:02:09,030
university college london and also

41
00:02:13,430 --> 00:02:10,860
working with the european space agency

42
00:02:15,860 --> 00:02:13,440
and so we proudly claim Giovanna

43
00:02:17,600 --> 00:02:15,870
one of our own and we're going to hear

44
00:02:19,760 --> 00:02:17,610
from her today about her work on

45
00:02:22,010 --> 00:02:19,770
extrasolar planets her title is

46
00:02:24,590 --> 00:02:22,020
observing extrasolar worlds from gas

47
00:02:27,380 --> 00:02:24,600
giant to terrestrial planets and I give

48
00:02:29,300 --> 00:02:27,390
you Giovanni tinetti well thank you so

49
00:02:31,700 --> 00:02:29,310
much Carl I mean these are this

50
00:02:35,660 --> 00:02:31,710
welcoming is I probably even to worry

51
00:02:37,250 --> 00:02:35,670
about I was moved by your words thank

52
00:02:39,590 --> 00:02:37,260
you so much forever inviting me here

53
00:02:43,100 --> 00:02:39,600
it's a really great pleasure and a great

54
00:02:46,610 --> 00:02:43,110
horner to get this time in ER and I made

55
00:02:49,700 --> 00:02:46,620
the sort of selection today put more

56
00:02:54,110 --> 00:02:49,710
about what we know now about excess oil

57
00:02:55,960 --> 00:02:54,120
planet and just leave the few minutes in

58
00:02:58,940 --> 00:02:55,970
the end to talk about perspective

59
00:03:01,070 --> 00:02:58,950
because i really think that we already

60
00:03:03,710 --> 00:03:01,080
can say a lot of things what we have

61
00:03:06,320 --> 00:03:03,720
reacties quorum most recently and what

62
00:03:09,230 --> 00:03:06,330
we are doing really today about his

63
00:03:11,630 --> 00:03:09,240

field this field is very recent because

64
00:03:13,850 --> 00:03:11,640
we have just to go back to nineteen

65
00:03:19,010 --> 00:03:13,860
ninety-five to find that the first

66
00:03:21,140 --> 00:03:19,020
assess well planet poor Bettina 51

67
00:03:25,910 --> 00:03:21,150
pegasi was discovered by the Geneva

68
00:03:27,770 --> 00:03:25,920
group of my own thoughts and it was

69
00:03:30,710 --> 00:03:27,780
compared by the group of Mars in

70
00:03:35,180 --> 00:03:30,720
bathurst NAFTA so it's very recent to

71
00:03:37,430 --> 00:03:35,190
field and since then actually I put here

72
00:03:41,780 --> 00:03:37,440
280 and I discovered this morning

73
00:03:44,060 --> 00:03:41,790
actually eggs a number is 294 so we are

74
00:03:46,070 --> 00:03:44,070
approaching the 300 it's just that you

75
00:03:48,050 --> 00:03:46,080
miss one day basically the number is

76
00:03:50,449 --> 00:03:48,060
going up and I should have seen this

77
00:03:54,229 --> 00:03:50,459
morning that there was announcement a

78
00:03:57,050 --> 00:03:54,239
new planet or 3.34 masses by my plastic

79
00:03:59,540 --> 00:03:57,060
and so congratulation to the team ooh

80
00:04:03,050 --> 00:03:59,550
did that but you can see that not only

81
00:04:05,180 --> 00:04:03,060
the number is increasing thanks since

82
00:04:08,060 --> 00:04:05,190
God the mass is decreasing so we are

83
00:04:12,170 --> 00:04:08,070
really approaching their hurry signs are

84
00:04:13,790 --> 00:04:12,180
planets now not only extrasolar planet

85
00:04:15,979 --> 00:04:13,800
in general are some important to be

86
00:04:17,750 --> 00:04:15,989
detected and discovered but certainly

87
00:04:20,420 --> 00:04:17,760
from a point of view especially of

88
00:04:24,190 --> 00:04:20,430

availability we really would like to

89
00:04:26,590 --> 00:04:24,200
know how they are for in the end

90
00:04:29,050 --> 00:04:26,600
how they evolved and what are their

91
00:04:31,150 --> 00:04:29,060
characteristics so the entire day is

92
00:04:34,060 --> 00:04:31,160
actually to not only to detect them but

93
00:04:35,770 --> 00:04:34,070
also to characterize them and for planet

94
00:04:39,280 --> 00:04:35,780
Earth are transiting and their parent

95
00:04:41,440 --> 00:04:39,290
star actually we can certainly do a lot

96
00:04:46,420 --> 00:04:41,450
of things right now and get a lot of

97
00:04:48,760 --> 00:04:46,430
information out of the observations why

98
00:04:50,800 --> 00:04:48,770
having a transiting planet is important

99
00:04:53,830 --> 00:04:50,810
what is important because if you can

100
00:04:56,290 --> 00:04:53,840
couple of the ID of the transit with the

101
00:04:58,690 --> 00:04:56,300
radial velocity measurement you can get

102
00:05:01,390 --> 00:04:58,700
the mass from the radial velocity and

103
00:05:03,040 --> 00:05:01,400
then the radius from the transit and so

104
00:05:05,650 --> 00:05:03,050
you can you fer the density of the

105
00:05:08,710 --> 00:05:05,660
planet and from the density you can

106
00:05:10,780 --> 00:05:08,720
really start to think what is internal

107
00:05:13,420 --> 00:05:10,790
structure it is a terrestrial planet or

108
00:05:16,690 --> 00:05:13,430
is a gas giant or is a Neptune planet

109
00:05:19,930 --> 00:05:16,700
and they're already several groups both

110
00:05:23,770 --> 00:05:19,940
Europe and the US that rain hours for in

111
00:05:26,950 --> 00:05:23,780
these very interesting field trying to

112
00:05:30,310 --> 00:05:26,960
understand if just looking at the radius

113
00:05:32,680 --> 00:05:30,320

versus mass diagram you can refer some

114
00:05:34,900 --> 00:05:32,690
of their internal properties so i put

115
00:05:36,910 --> 00:05:34,910
here a graph that is coming from the

116
00:05:40,540 --> 00:05:36,920
group of certain engrossing knowns in

117
00:05:44,590 --> 00:05:40,550
particular but there are several models

118
00:05:46,600 --> 00:05:44,600
for similar bar forney by Seager and the

119
00:05:49,510 --> 00:05:46,610
idea is that a lease for the planet in

120
00:05:53,560 --> 00:05:49,520
our solar system just looking at diagram

121
00:05:56,380 --> 00:05:53,570
like that you can already do have a

122
00:05:58,720 --> 00:05:56,390
Berbick division between the terrestrial

123
00:06:02,350 --> 00:05:58,730
planet that are for now they're composed

124
00:06:05,200 --> 00:06:02,360
more silicate and rock like earth Venus

125
00:06:08,260 --> 00:06:05,210
and Mars or the planets that contains a

126
00:06:11,470 --> 00:06:08,270
actually non negligible amount of ice

127
00:06:13,540 --> 00:06:11,480
and so the ratio between the radiosonde

128
00:06:15,340 --> 00:06:13,550
the mass is definitely different and you

129
00:06:18,190 --> 00:06:15,350
can see that in this particular diagram

130
00:06:21,010 --> 00:06:18,200
but then people have fought also more

131
00:06:22,660 --> 00:06:21,020
exotic work like the carbon planet that

132
00:06:25,510 --> 00:06:22,670
we're proposed by Kirchner and Seager

133
00:06:27,490 --> 00:06:25,520
and we have probably to have much more

134
00:06:33,430 --> 00:06:27,500
statistics you understand if they're

135
00:06:35,470 --> 00:06:33,440
real or a virtuous possible okay I told

136
00:06:37,300 --> 00:06:35,480
you that the field oxo planet is brand

137
00:06:40,540 --> 00:06:37,310
new by the filter of

138
00:06:42,490 --> 00:06:40,550

transit is even more new and this is

139
00:06:45,400 --> 00:06:42,500
because the first primary transit the

140
00:06:47,290 --> 00:06:45,410
first the transit for an excess of

141
00:06:51,850 --> 00:06:47,300
planet was observed by the grouper

142
00:06:55,270 --> 00:06:51,860
Charbonneau and his team and basically

143
00:06:57,790 --> 00:06:55,280
what they did in two thousand was to

144
00:07:00,400 --> 00:06:57,800
measure the flux of the star and then

145
00:07:02,230 --> 00:07:00,410
measure the dimming of this flux when

146
00:07:05,020 --> 00:07:02,240
the planet is basically passing in front

147
00:07:07,600 --> 00:07:05,030
of it and so this technique is called

148
00:07:11,170 --> 00:07:07,610
the primary transit and the entire idea

149
00:07:14,320 --> 00:07:11,180
is that by measuring the demon first of

150
00:07:16,240 --> 00:07:14,330
all you can in fear basically the radius

151
00:07:18,820 --> 00:07:16,250
of the planet with respect to the radius

152
00:07:20,770 --> 00:07:18,830
of the star and just to give you an idea

153
00:07:23,920 --> 00:07:20,780
if you're talking about a gas giant

154
00:07:26,620 --> 00:07:23,930
planet that is transiting and G type of

155
00:07:29,650 --> 00:07:26,630
star like our own Sun here we're talking

156
00:07:32,950 --> 00:07:29,660
about 1% more or less this ratio of

157
00:07:35,080 --> 00:07:32,960
surfaces is about 1% and of course this

158
00:07:36,910 --> 00:07:35,090
ratio is changing depending if the

159
00:07:41,320 --> 00:07:36,920
finance is smaller or bigger or and but

160
00:07:44,170 --> 00:07:41,330
also the type of the star but not only

161
00:07:46,690 --> 00:07:44,180
this is extremely important you can also

162
00:07:50,320 --> 00:07:46,700
derive with transiting planet a lot of

163
00:07:54,580 --> 00:07:50,330

the parameters our orbital parameters so

164
00:07:56,590 --> 00:07:54,590
not only planetary parameters but also

165
00:07:58,870 --> 00:07:56,600
what I am particularly interested in a

166
00:08:02,280 --> 00:07:58,880
lot of people are extremely interested

167
00:08:05,500 --> 00:08:02,290
in is that for some of these objects

168
00:08:07,180 --> 00:08:05,510
usually the biggest one at the moments

169
00:08:09,910 --> 00:08:07,190
but of course the techniques are I

170
00:08:12,730 --> 00:08:09,920
getting better and better you can also

171
00:08:15,700 --> 00:08:12,740
pro basically the atmosphere and in this

172
00:08:19,060 --> 00:08:15,710
case will be an analyst so the limbo the

173
00:08:21,550 --> 00:08:19,070
planet and just to give you an idea of

174
00:08:24,040 --> 00:08:21,560
how small is this quantity we are

175
00:08:25,900 --> 00:08:24,050
talking about our number which is more

176
00:08:27,640 --> 00:08:25,910
or less the point to one percent of

177
00:08:30,190 --> 00:08:27,650
course this number is changing depending

178
00:08:33,070 --> 00:08:30,200
on which wavelength you're concentrating

179
00:08:35,560 --> 00:08:33,080
in but this is just like Anibal Park to

180
00:08:38,530 --> 00:08:35,570
give you an impression so it's very tiny

181
00:08:43,710 --> 00:08:38,540
compared to the one percent but we

182
00:08:45,350 --> 00:08:43,720
cannot already now probe this sort of

183
00:08:49,190 --> 00:08:45,360
numbers

184
00:08:51,079 --> 00:08:49,200
so in order to understand what is going

185
00:08:53,269 --> 00:08:51,089
on in the atmosphere is a slow planet

186
00:08:57,860 --> 00:08:53,279
using this type of technique primary

187
00:09:01,340 --> 00:08:57,870
transit there were several papers coming

188
00:09:04,280 --> 00:09:01,350

out vertical papers and one of the I

189
00:09:06,710 --> 00:09:04,290
would say the priority benchmark paper

190
00:09:09,380 --> 00:09:06,720
is the cigarettes a solo in two thousand

191
00:09:12,110 --> 00:09:09,390
they proposed for the first time to use

192
00:09:13,730 --> 00:09:12,120
this technique to specifically probe the

193
00:09:15,680 --> 00:09:13,740
atmosphere and excess oil planet and

194
00:09:18,050 --> 00:09:15,690
there were more concentrating in

195
00:09:21,800 --> 00:09:18,060
simulation in the UV and the visible and

196
00:09:26,329 --> 00:09:21,810
this is because in bossier hubble was a

197
00:09:28,670 --> 00:09:26,339
very popular so that was the obvious

198
00:09:32,120 --> 00:09:28,680
starting point from a point of view of

199
00:09:36,410 --> 00:09:32,130
observations another bench my paper is

200
00:09:38,720 --> 00:09:36,420
the brown 2001 model the spectrum

201
00:09:43,370 --> 00:09:38,730
transmission and visible and

202
00:09:46,069 --> 00:09:43,380
near-infrared great paper and I most

203
00:09:48,560 --> 00:09:46,079
recently look into the possibility of a

204
00:09:50,810 --> 00:09:48,570
fine his primary transit technique in

205
00:09:55,160 --> 00:09:50,820
the mirror infrared and the reason for

206
00:09:58,519 --> 00:09:55,170
doing so is that a Spitzer was was

207
00:10:01,280 --> 00:09:58,529
actually working and am very well and

208
00:10:04,100 --> 00:10:01,290
also in the middle infrared that you can

209
00:10:07,009 --> 00:10:04,110
actually probe some of the molecules and

210
00:10:10,730 --> 00:10:07,019
not necessarily are obviously detectable

211
00:10:12,590 --> 00:10:10,740
in the visible part of the spectrum but

212
00:10:14,780 --> 00:10:12,600
there is a complementary technique to

213
00:10:16,730 --> 00:10:14,790

the one and i just showed to you it's a

214
00:10:20,240 --> 00:10:16,740
so-called secondary transit technique

215
00:10:22,430 --> 00:10:20,250
and here the idea is you're looking at

216
00:10:23,930 --> 00:10:22,440
the flux of the star and upon it

217
00:10:26,360 --> 00:10:23,940
together so you take together the

218
00:10:28,430 --> 00:10:26,370
package starring planet and then you

219
00:10:32,110 --> 00:10:28,440
wait for the planet to be hidden by the

220
00:10:35,329 --> 00:10:32,120
star and so as you can imagine the

221
00:10:37,759 --> 00:10:35,339
starplex planet flux is Dean's at this

222
00:10:40,689 --> 00:10:37,769
point and you can subtract the

223
00:10:44,060 --> 00:10:40,699
contribution of the star so in this way

224
00:10:47,509 --> 00:10:44,070
you're sort of probing fortunes lighter

225
00:10:51,980 --> 00:10:47,519
which is directly meted or reflected by

226
00:10:54,110 --> 00:10:51,990
the planet so because of these the

227
00:10:57,410 --> 00:10:54,120
technique is really complementary to the

228
00:10:58,850 --> 00:10:57,420
to the primary transit where you're

229
00:11:01,190 --> 00:10:58,860
looking basically

230
00:11:05,390 --> 00:11:01,200
Attis mottram at aspect that is

231
00:11:09,290 --> 00:11:05,400
transmitted of course depending on the

232
00:11:12,320 --> 00:11:09,300
wavelength we are using for doing this

233
00:11:15,680 --> 00:11:12,330
sort of observation the kind of

234
00:11:19,130 --> 00:11:15,690
information we can we can have is very

235
00:11:22,250 --> 00:11:19,140
different so if we do secondary transit

236
00:11:25,460 --> 00:11:22,260
and the visible part of the spectrum we

237
00:11:28,490 --> 00:11:25,470
can certainly probe the albedo of the

238
00:11:30,890 --> 00:11:28,500

planet because in the visible is where

239
00:11:35,750 --> 00:11:30,900
we have the control of the multiple

240
00:11:39,580 --> 00:11:35,760
scattering and if there are clouds

241
00:11:42,140 --> 00:11:39,590
probably they'll be they should change

242
00:11:44,270 --> 00:11:42,150
if we are basically applying this

243
00:11:46,940 --> 00:11:44,280
technique in the infrared part of the

244
00:11:48,740 --> 00:11:46,950
spectrum then you're looking at light

245
00:11:51,740 --> 00:11:48,750
that is emitted directed by the planet

246
00:11:54,260 --> 00:11:51,750
and so basically you can probe above the

247
00:11:56,510 --> 00:11:54,270
the presence of molecules absorbing in

248
00:11:58,340 --> 00:11:56,520
the atmosphere and having some

249
00:12:01,760 --> 00:11:58,350
transition and infrared part of the

250
00:12:03,530 --> 00:12:01,770
spectrum but you can also have a very

251
00:12:06,050 --> 00:12:03,540
good probe of the thermal structure of

252
00:12:08,830 --> 00:12:06,060
the atmosphere and this is because again

253
00:12:11,510 --> 00:12:08,840
in emission spectroscopy and in infrared

254
00:12:16,370 --> 00:12:11,520
you definitely can probe disorder

255
00:12:18,770 --> 00:12:16,380
quantities up till now the planets we

256
00:12:21,080 --> 00:12:18,780
have we have been able to follow with

257
00:12:23,990 --> 00:12:21,090
this technique in terms of atmospheric

258
00:12:27,460 --> 00:12:24,000
authorization are especially hot

259
00:12:30,500 --> 00:12:27,470
Jupiters so it's a new class of object

260
00:12:33,140 --> 00:12:30,510
that before we discover excess oil

261
00:12:35,780 --> 00:12:33,150
planet we were unaware they could exist

262
00:12:38,660 --> 00:12:35,790
a certain they are not present in our

263
00:12:41,990 --> 00:12:38,670

solar system and the reason there is so

264
00:12:45,170 --> 00:12:42,000
popular in terms of observation is

265
00:12:48,320 --> 00:12:45,180
because well there are gas giant planet

266
00:12:51,260 --> 00:12:48,330
orbiting very close to the scar so the

267
00:12:53,840 --> 00:12:51,270
temperature can be very high meaning

268
00:12:56,420 --> 00:12:53,850
that also the atmosphere is very

269
00:12:59,150 --> 00:12:56,430
standard and all these characteristics

270
00:13:02,480 --> 00:12:59,160
makes them an excellent are going to be

271
00:13:07,220 --> 00:13:02,490
probed with transit technique we believe

272
00:13:11,180 --> 00:13:07,230
that most of them were at least some of

273
00:13:12,020 --> 00:13:11,190
them are totally locked probably not all

274
00:13:15,410 --> 00:13:12,030
of them

275
00:13:19,280 --> 00:13:15,420
but also we don't know right now even

276
00:13:22,730 --> 00:13:19,290
for those that might be quite a lot how

277
00:13:25,460 --> 00:13:22,740
deep can be the tidal luck with the

278
00:13:27,590 --> 00:13:25,470
planet and this information could help

279
00:13:33,290 --> 00:13:27,600
out actually understanding better that I

280
00:13:35,360 --> 00:13:33,300
not exalt these atmospheres so a hot

281
00:13:38,000 --> 00:13:35,370
Jupiter were probed at the beginning few

282
00:13:39,760 --> 00:13:38,010
years ago especially in the view in the

283
00:13:44,210 --> 00:13:39,770
UV and visible part of the spectrum

284
00:13:45,830 --> 00:13:44,220
using Hubble and most a telescope and if

285
00:13:50,600 --> 00:13:45,840
you look in those wavelengths you can

286
00:13:53,750 --> 00:13:50,610
probe atomic species I own species the

287
00:13:55,580 --> 00:13:53,760
presence of clouds or Hayes's and more

288
00:13:58,370 --> 00:13:55,590

in general really probing the upper

289
00:14:01,640 --> 00:13:58,380
atmosphere so the boundary conditions

290
00:14:04,820 --> 00:14:01,650
and definitely the sort of information

291
00:14:07,540 --> 00:14:04,830
is this frame useful for all the models

292
00:14:12,560 --> 00:14:07,550
in 3d that absolutely need is a

293
00:14:18,260 --> 00:14:12,570
disinformation to be able to to be more

294
00:14:22,100 --> 00:14:18,270
on to be improved the first measurement

295
00:14:24,800 --> 00:14:22,110
of the most current component in an

296
00:14:29,720 --> 00:14:24,810
extrasolar planet was done again by

297
00:14:32,990 --> 00:14:29,730
Charbonneau in 2002 and it looked at the

298
00:14:35,420 --> 00:14:33,000
planet called so-called ht29 458 be

299
00:14:39,740 --> 00:14:35,430
unfortunately spina have unpronounceable

300
00:14:41,630 --> 00:14:39,750
name and he use the instruments dissin

301
00:14:44,660 --> 00:14:41,640
border Hubble and you look at the line

302
00:14:47,330 --> 00:14:44,670
of sodium and it could definitely detect

303
00:14:50,300 --> 00:14:47,340
an absorption in those lines about point

304
00:14:53,030 --> 00:14:50,310
O 2 percent was changing a little bit

305
00:14:57,050 --> 00:14:53,040
this lumber depending our close to this

306
00:15:00,770 --> 00:14:57,060
the center of the line it was a probing

307
00:15:03,470 --> 00:15:00,780
and basically similar observation were

308
00:15:05,330 --> 00:15:03,480
repeated more recently from the ground

309
00:15:07,640 --> 00:15:05,340
actually the first the ground-based

310
00:15:10,220 --> 00:15:07,650
observation and first ground based

311
00:15:11,780 --> 00:15:10,230
detection of animus great component was

312
00:15:14,390 --> 00:15:11,790
down last year by the group of rats

313
00:15:18,170 --> 00:15:14,400

villa talk and this time the sodium was

314
00:15:21,350 --> 00:15:18,180
found on another planet hot Jupiter HD

315
00:15:23,920 --> 00:15:21,360
189733 B and it turns out it actually

316
00:15:26,290 --> 00:15:23,930
looks like sodium is three times more

317
00:15:30,070 --> 00:15:26,300
this particular planet rather than the

318
00:15:34,560 --> 00:15:30,080
14 by Charbonneau more measurement from

319
00:15:37,870 --> 00:15:34,570
the ground confirming what Charbonneau

320
00:15:39,700 --> 00:15:37,880
probe in 2002 and then there is an

321
00:15:43,480 --> 00:15:39,710
entire literature actually already

322
00:15:48,310 --> 00:15:43,490
trying to explain immediately after the

323
00:15:50,590 --> 00:15:48,320
observation but also most recently why

324
00:15:52,690 --> 00:15:50,600
there was so little soldier or weather

325
00:15:54,610 --> 00:15:52,700
is so much so doing in this case for the

326
00:15:58,329 --> 00:15:54,620
other planet and there are several

327
00:16:01,150 --> 00:15:58,339
explanation what I personally like a lot

328
00:16:05,530 --> 00:16:01,160
is the one given by atria just last year

329
00:16:09,400 --> 00:16:05,540
where is sort of proposed that actually

330
00:16:12,490 --> 00:16:09,410
sodium might be due to pasta

331
00:16:16,000 --> 00:16:12,500
accretionary source so basically getting

332
00:16:19,180 --> 00:16:16,010
into the atmosphere not as an original

333
00:16:21,430 --> 00:16:19,190
source but afta from debris and

334
00:16:23,410 --> 00:16:21,440
meteorites and comments and that could

335
00:16:26,320 --> 00:16:23,420
explain why we're seeing this sort of

336
00:16:28,480 --> 00:16:26,330
our ability we have only two planets at

337
00:16:30,820 --> 00:16:28,490
the moment haven't is there's a

338
00:16:33,699 --> 00:16:30,830

particular signature but we hope that we

339
00:16:36,640 --> 00:16:33,709
can drop more planets and understand a

340
00:16:38,710 --> 00:16:36,650
little bit more what is going on another

341
00:16:41,890 --> 00:16:38,720
important observation in this field

342
00:16:46,180 --> 00:16:41,900
there was the one done looking at the

343
00:16:48,519 --> 00:16:46,190
Limon alpha line hydrogen line and in

344
00:16:50,620 --> 00:16:48,529
the UV part of the spectrum and this was

345
00:16:56,110 --> 00:16:50,630
done by the group of Adama jar in Paris

346
00:16:58,240 --> 00:16:56,120
in 2003 and the group were measured a

347
00:17:00,130 --> 00:16:58,250
huge absorption in this line we are

348
00:17:02,949 --> 00:17:00,140
talking about fifteen percent is

349
00:17:07,240 --> 00:17:02,959
enormous it means that actually is more

350
00:17:09,520 --> 00:17:07,250
than the planetary radius more recently

351
00:17:11,380 --> 00:17:09,530
there was a reduction of the data and

352
00:17:13,120 --> 00:17:11,390
this mom burst seems to be little bit

353
00:17:16,780 --> 00:17:13,130
less but still we're talking about nine

354
00:17:18,460 --> 00:17:16,790
percent is still huge number so this is

355
00:17:22,990 --> 00:17:18,470
telling us that something is going on

356
00:17:24,640 --> 00:17:23,000
and one of this planation of the that

357
00:17:26,949 --> 00:17:24,650
was given originally by the group who

358
00:17:29,230 --> 00:17:26,959
made the observation was that ain't our

359
00:17:33,040 --> 00:17:29,240
plan was evaporating and it was odd

360
00:17:34,740 --> 00:17:33,050
region escape in the upper atmosphere of

361
00:17:37,390 --> 00:17:34,750
the planet

362
00:17:41,230 --> 00:17:37,400
there are several model that followed

363
00:17:44,050 --> 00:17:41,240

that prediction and the most recent one

364
00:17:47,980 --> 00:17:44,060
our costume it's all two thousand hate

365
00:17:50,170 --> 00:17:47,990
they propose a 3d model of a upper

366
00:17:55,170 --> 00:17:50,180
atmosphere of a gas giant planet hot

367
00:17:58,720 --> 00:17:55,180
Jupiters and they propose actually could

368
00:18:00,880 --> 00:17:58,730
see that this particular planet the one

369
00:18:04,240 --> 00:18:00,890
observed is certainly in the condition

370
00:18:05,980 --> 00:18:04,250
of instability so potentially could

371
00:18:07,860 --> 00:18:05,990
evaporate and potentially there could be

372
00:18:11,080 --> 00:18:07,870
a Trojan escape in the upper atmosphere

373
00:18:12,670 --> 00:18:11,090
what we don't know right now is if this

374
00:18:15,850 --> 00:18:12,680
planet has a magnetic field or not

375
00:18:18,990 --> 00:18:15,860
because in that case the what is

376
00:18:21,550 --> 00:18:19,000
inferred by modeling could change a lot

377
00:18:23,320 --> 00:18:21,560
another explanation that was giving

378
00:18:25,540 --> 00:18:23,330
about an hour group homes from it all

379
00:18:27,460 --> 00:18:25,550
another nature paper so this observation

380
00:18:30,670 --> 00:18:27,470
keeps actually providing nature paper as

381
00:18:32,650 --> 00:18:30,680
you can see is that actually the

382
00:18:34,960 --> 00:18:32,660
observation was probably in stellar wind

383
00:18:38,590 --> 00:18:34,970
so not necessarily the upper atmosphere

384
00:18:41,040 --> 00:18:38,600
of the planet but actually a much more

385
00:18:44,020 --> 00:18:41,050
complex situation where you have a

386
00:18:45,640 --> 00:18:44,030
combination of stellar wind upper part

387
00:18:47,920 --> 00:18:45,650
of the plan upper hemisphere of the

388
00:18:49,840 --> 00:18:47,930

planet and certainly if there is a

389
00:18:53,050 --> 00:18:49,850
magnetic field all the situation can be

390
00:18:54,820 --> 00:18:53,060
a swimming complex so I think we

391
00:18:57,660 --> 00:18:54,830
definitely would like to see more

392
00:19:00,330 --> 00:18:57,670
observation of this time upon on

393
00:19:04,360 --> 00:19:00,340
different huh tributaries that you see

394
00:19:07,360 --> 00:19:04,370
exactly what is going on unfortunately

395
00:19:11,110 --> 00:19:07,370
the instrument stays onboard acabo is no

396
00:19:14,380 --> 00:19:11,120
longer working and people try to use on

397
00:19:17,020 --> 00:19:14,390
our instrument aboard Hubble ACS looking

398
00:19:20,080 --> 00:19:17,030
at visible or near-uv part of the

399
00:19:22,750 --> 00:19:20,090
spectrum and I'm showing you here

400
00:19:26,710 --> 00:19:22,760
basically a couple of papers that came

401
00:19:29,890 --> 00:19:26,720
out the one knutson at all and the pawn

402
00:19:34,630 --> 00:19:29,900
is all using acs for two different

403
00:19:35,410 --> 00:19:34,640
planets and unfortunately acs spectral

404
00:19:37,660 --> 00:19:35,420
resolution

405
00:19:39,070 --> 00:19:37,670
is not good enough for the visible or

406
00:19:41,500 --> 00:19:39,080
you'll be part of the spectrum and this

407
00:19:46,420 --> 00:19:41,510
is because if you're expecting to find

408
00:19:49,870 --> 00:19:46,430
all these sodium metal soon a potassium

409
00:19:53,770 --> 00:19:49,880
line so alkali metal lines they all have

410
00:19:55,780 --> 00:19:53,780
this very narrow signature and so if you

411
00:19:58,570 --> 00:19:55,790
start to dilute the resolution instead

412
00:20:03,250 --> 00:19:58,580
of seeing this very nice peak you see

413
00:20:05,290 --> 00:20:03,260

just a bump and so for instance with ACS

414
00:20:08,410 --> 00:20:05,300
you're not able to confer measurement

415
00:20:13,330 --> 00:20:08,420
that we're already done with this this

416
00:20:16,120 --> 00:20:13,340
seems also to be i mean acs seems to

417
00:20:19,090 --> 00:20:16,130
suggest that also water and clouds is

418
00:20:21,820 --> 00:20:19,100
present and this is because clouds and

419
00:20:23,710 --> 00:20:21,830
haze is because this factor s seems to

420
00:20:25,770 --> 00:20:23,720
be pretty flat in the visible so it

421
00:20:29,050 --> 00:20:25,780
looks like you have some sort of

422
00:20:31,810 --> 00:20:29,060
opacities that is not allowing you to

423
00:20:34,060 --> 00:20:31,820
see very deep in the atmosphere but then

424
00:20:36,520 --> 00:20:34,070
it's all suggested because again the

425
00:20:41,080 --> 00:20:36,530
resolution is not really i enough but to

426
00:20:43,150 --> 00:20:41,090
be very conclusive very nice

427
00:20:47,920 --> 00:20:43,160
contribution was given by Moses

428
00:20:50,160 --> 00:20:47,930
satellite they looked at jupiter planet

429
00:20:52,720 --> 00:20:50,170
during live planet hot Jupiters

430
00:20:55,120 --> 00:20:52,730
indivisible with visible broadband

431
00:20:58,150 --> 00:20:55,130
photometry so they really look at the

432
00:21:00,010 --> 00:20:58,160
sort of entire check of the visible

433
00:21:03,010 --> 00:21:00,020
spectrum and in particularly

434
00:21:07,210 --> 00:21:03,020
concentrating in two different planets

435
00:21:09,040 --> 00:21:07,220
and for one of them hd2 an eye for 48 be

436
00:21:11,980 --> 00:21:09,050
they could measure using secondary

437
00:21:13,480 --> 00:21:11,990
transit technique the albedo and the

438
00:21:18,910 --> 00:21:13,490

beetle seems to be used to reveal Oh

439
00:21:21,340 --> 00:21:18,920
something less than point 25 and again

440
00:21:23,770 --> 00:21:21,350
this number is is tremolo especially if

441
00:21:27,760 --> 00:21:23,780
compared with the planet we know in our

442
00:21:29,560 --> 00:21:27,770
solar system gas giant or Tyson so it

443
00:21:32,410 --> 00:21:29,570
really looks like very reflective clouds

444
00:21:38,170 --> 00:21:32,420
are ruled out because of this

445
00:21:40,990 --> 00:21:38,180
measurement let me bring you now into

446
00:21:45,010 --> 00:21:41,000
the infrared part of the spectrum and

447
00:21:46,930 --> 00:21:45,020
the Spitzer and Nick MOS ear era nick

448
00:21:48,530 --> 00:21:46,940
moses on our instrument aboard a hubble

449
00:21:50,680 --> 00:21:48,540
but is probing

450
00:21:54,170 --> 00:21:50,690
in the new infrared part of the spectrum

451
00:21:57,500 --> 00:21:54,180
now if you if you are in the infrared

452
00:22:01,640 --> 00:21:57,510
you can definitely observe and attack

453
00:22:03,410 --> 00:22:01,650
their species you can have an idea what

454
00:22:05,990 --> 00:22:03,420
is going on about them of bothell and

455
00:22:07,790 --> 00:22:06,000
thermal structures so you have an idea

456
00:22:10,070 --> 00:22:07,800
of what is going on of these very

457
00:22:12,530 --> 00:22:10,080
complex dynamics of these planetary

458
00:22:15,110 --> 00:22:12,540
atmospheres and potentially you could

459
00:22:17,980 --> 00:22:15,120
pro cause on Hayes's even though for the

460
00:22:21,290 --> 00:22:17,990
moment we don't have a too many

461
00:22:23,300 --> 00:22:21,300
detection of those more in general with

462
00:22:25,100 --> 00:22:23,310
respect to what you're doing in the UV

463
00:22:28,630 --> 00:22:25,110

and visible you're really probing much

464
00:22:33,500 --> 00:22:28,640
deeper in the atmosphere of a planet a

465
00:22:37,460 --> 00:22:33,510
very nice result the light curve probed

466
00:22:40,220 --> 00:22:37,470
by the group of nuts in it all in 2007

467
00:22:43,580 --> 00:22:40,230
and even more recently at a micron and

468
00:22:46,340 --> 00:22:43,590
24 microm physically was they did was to

469
00:22:48,080 --> 00:22:46,350
follow the planet during his orbit and

470
00:22:50,960 --> 00:22:48,090
so measuring from primary to secondary

471
00:22:53,090 --> 00:22:50,970
and by following this planet in his

472
00:22:57,200 --> 00:22:53,100
light curve they could probe that the

473
00:22:58,490 --> 00:22:57,210
bulk temperature is actually seems to be

474
00:23:02,060 --> 00:22:58,500
very well mixed in this particular

475
00:23:05,480 --> 00:23:02,070
planet which is HD 189 so it looks like

476
00:23:07,520 --> 00:23:05,490
the dynamics is efficient enough that

477
00:23:10,130 --> 00:23:07,530
you sort of makes the day side and the

478
00:23:12,560 --> 00:23:10,140
night side of the planet and this is

479
00:23:14,930 --> 00:23:12,570
situation is very different from the one

480
00:23:17,990 --> 00:23:14,940
on the contrary probe by an hour group

481
00:23:21,050 --> 00:23:18,000
our internet hall and there not another

482
00:23:22,790 --> 00:23:21,060
very nice paper and they look a hoop

483
00:23:26,750 --> 00:23:22,800
salon drama it is actually a planet that

484
00:23:28,730 --> 00:23:26,760
doesn't transit so that can give you an

485
00:23:31,370 --> 00:23:28,740
idea of how powerful this technique can

486
00:23:33,380 --> 00:23:31,380
be you don't need a surly transit but

487
00:23:36,230 --> 00:23:33,390
the planet is basically orbiting close

488
00:23:39,790 --> 00:23:36,240

enough to the scar and he is hot enough

489
00:23:42,440 --> 00:23:39,800
to be able to be probed with Spitzer and

490
00:23:45,230 --> 00:23:42,450
it looks like this particular planet on

491
00:23:48,380 --> 00:23:45,240
the contrary showing huge gradient of

492
00:23:50,510 --> 00:23:48,390
temperature between day and night so

493
00:23:52,700 --> 00:23:50,520
again two different planets that are

494
00:23:54,230 --> 00:23:52,710
probe and very different answers so

495
00:23:56,330 --> 00:23:54,240
we're already seeing a lot of very

496
00:23:59,150 --> 00:23:56,340
abilities in this object so we probably

497
00:24:02,630 --> 00:23:59,160
should be careful in just classify them

498
00:24:04,680 --> 00:24:02,640
as it just one box of thing

499
00:24:08,220 --> 00:24:04,690
but what I would like to discuss a

500
00:24:10,200 --> 00:24:08,230
little bit more today with you as the

501
00:24:14,220 --> 00:24:10,210
new direction that all this field is is

502
00:24:17,300 --> 00:24:14,230
is bringing in from photochemical models

503
00:24:19,710 --> 00:24:17,310
what we knew fear is a few years ago

504
00:24:24,930 --> 00:24:19,720
especially from the works of young at

505
00:24:27,930 --> 00:24:24,940
all in 2003 in 2004 was that Adam if the

506
00:24:29,760 --> 00:24:27,940
carbon versus oxygen ratio is more or

507
00:24:31,530 --> 00:24:29,770
less equal solar for this planet which

508
00:24:34,980 --> 00:24:31,540
is a reasonable assumption if you don't

509
00:24:37,380 --> 00:24:34,990
know better this number then actually

510
00:24:39,780 --> 00:24:37,390
you should expect to have water in a non

511
00:24:42,600 --> 00:24:39,790
negligible quantity in these hot

512
00:24:45,810 --> 00:24:42,610
Jupiters and time on is for is

513
00:24:47,640 --> 00:24:45,820

definitely kind of abundant is more or

514
00:24:50,370 --> 00:24:47,650
less the same quantity we have on earth

515
00:24:54,720 --> 00:24:50,380
of water when your are above the clouds

516
00:24:56,910 --> 00:24:54,730
and according to these models for this

517
00:25:00,810 --> 00:24:56,920
hot Jupiter we should have expect a lot

518
00:25:02,640 --> 00:25:00,820
of CEO almost abundant as water and this

519
00:25:06,810 --> 00:25:02,650
is because they're very hot environment

520
00:25:09,720 --> 00:25:06,820
and carbon bearing species seems to go

521
00:25:13,710 --> 00:25:09,730
more towards the CEO side rather than

522
00:25:15,330 --> 00:25:13,720
beneath inside and also because me

523
00:25:17,460 --> 00:25:15,340
thinning the armor in the upper

524
00:25:19,560 --> 00:25:17,470
atmosphere on this planet is supposed to

525
00:25:22,680 --> 00:25:19,570
be fertilized very efficiently because

526
00:25:26,760 --> 00:25:22,690
of this very huge radiation and then

527
00:25:30,300 --> 00:25:26,770
these were the models then there were

528
00:25:32,280 --> 00:25:30,310
several times actually to try to probe a

529
00:25:35,700 --> 00:25:32,290
really the presence of water and to

530
00:25:38,430 --> 00:25:35,710
confirm these models and today I'm

531
00:25:41,340 --> 00:25:38,440
telling you about what we we did in the

532
00:25:43,890 --> 00:25:41,350
in the infrared part of the spectrum the

533
00:25:46,830 --> 00:25:43,900
entire idea was to use primary transit

534
00:25:49,140 --> 00:25:46,840
technique but in the infrared and

535
00:25:52,740 --> 00:25:49,150
basically to look at this one while it

536
00:25:55,260 --> 00:25:52,750
was transiting and use a basically free

537
00:25:59,910 --> 00:25:55,270
different band very different Spitzer

538
00:26:04,470 --> 00:25:59,920

bands and what what turned out is that

539
00:26:07,230 --> 00:26:04,480
the planet seems to be much larger a 5.8

540
00:26:09,300 --> 00:26:07,240
rather than a three point six meaning

541
00:26:12,090 --> 00:26:09,310
that of course these effects are here is

542
00:26:14,760 --> 00:26:12,100
magnified just to show you the behavior

543
00:26:17,250 --> 00:26:14,770
but in toy idea is that

544
00:26:19,860 --> 00:26:17,260
possibly something is absorbing much

545
00:26:21,900 --> 00:26:19,870
more efficiently at 5.8 microns so

546
00:26:24,510 --> 00:26:21,910
that's why the planet is much larger and

547
00:26:27,390 --> 00:26:24,520
this is because the lights is basically

548
00:26:29,790 --> 00:26:27,400
blocked at an eye on elder level of the

549
00:26:33,270 --> 00:26:29,800
atmosphere so it looks larger on the

550
00:26:35,160 --> 00:26:33,280
contrary at 3.6 what's happening since

551
00:26:37,560 --> 00:26:35,170
they are most fearsome to be much more

552
00:26:39,360 --> 00:26:37,570
transparent so that's why that the

553
00:26:41,730 --> 00:26:39,370
planet looks much smaller and this is

554
00:26:44,640 --> 00:26:41,740
because the light can really rub much

555
00:26:47,670 --> 00:26:44,650
deeper and then if you put these three

556
00:26:51,150 --> 00:26:47,680
measurements as a function of wavelength

557
00:26:53,750 --> 00:26:51,160
and you look at this Addie's result

558
00:26:55,950 --> 00:26:53,760
actually you might think that a lot of

559
00:26:58,020 --> 00:26:55,960
molecule a lot of situation might

560
00:27:01,080 --> 00:26:58,030
explain is rebalance but actually the

561
00:27:03,420 --> 00:27:01,090
most obvious one is to to think that

562
00:27:06,420 --> 00:27:03,430
what is absorbing because water is able

563
00:27:10,010 --> 00:27:06,430

really to explain very well there's this

564
00:27:12,720 --> 00:27:10,020
behavior of course the three bands are

565
00:27:14,910 --> 00:27:12,730
almost enough to tell you the water is

566
00:27:17,100 --> 00:27:14,920
there but certainly there is not on the

567
00:27:19,790 --> 00:27:17,110
water and you can't imagine that there

568
00:27:22,650 --> 00:27:19,800
is something else is that that with

569
00:27:26,220 --> 00:27:22,660
broadband photometry you're not able to

570
00:27:28,440 --> 00:27:26,230
be sensitive to the songs in us so what

571
00:27:31,020 --> 00:27:28,450
we did actually was to look at the same

572
00:27:33,720 --> 00:27:31,030
planet and to use an hour instrument

573
00:27:38,610 --> 00:27:33,730
Nick most this time Hubble instrument

574
00:27:41,520 --> 00:27:38,620
and in the near infrared we could get

575
00:27:44,400 --> 00:27:41,530
much more points actually are the black

576
00:27:47,460 --> 00:27:44,410
one and all these points are telling us

577
00:27:49,980 --> 00:27:47,470
that water is certainly explaining part

578
00:27:52,680 --> 00:27:49,990
of the behavior and the modulation but

579
00:27:57,140 --> 00:27:52,690
it's not netting is not able to explain

580
00:28:00,330 --> 00:27:57,150
all of the story and after a lot of

581
00:28:03,720 --> 00:28:00,340
tries we could find a me think what

582
00:28:05,610 --> 00:28:03,730
actually is playing very well and I just

583
00:28:08,430 --> 00:28:05,620
told you the meeting was supposed to be

584
00:28:10,680 --> 00:28:08,440
negligible in this planet and but what

585
00:28:14,670 --> 00:28:10,690
we found was actually that was not

586
00:28:18,090 --> 00:28:14,680
negligible at all so what can be a

587
00:28:20,370 --> 00:28:18,100
destination well first of all here we

588
00:28:22,290 --> 00:28:20,380

are in a measurement in primary transit

589
00:28:24,840 --> 00:28:22,300
meaning that we're looking at the

590
00:28:26,940 --> 00:28:24,850
Terminator the Terminator is this line

591
00:28:27,340 --> 00:28:26,950
that is dividing the nice side from the

592
00:28:30,340 --> 00:28:27,350
day

593
00:28:32,289 --> 00:28:30,350
side and so most probably we are very

594
00:28:35,440 --> 00:28:32,299
sensitive to what is going on in

595
00:28:37,450 --> 00:28:35,450
eyesight of this planet so at the night

596
00:28:39,700 --> 00:28:37,460
side of this planet the temperature can

597
00:28:44,320 --> 00:28:39,710
potentially drop and is it comes out

598
00:28:46,600 --> 00:28:44,330
from our observations to 900 800 so

599
00:28:49,210 --> 00:28:46,610
these are temperature for which me

600
00:28:53,440 --> 00:28:49,220
thinkest are to be unimportant species

601
00:28:55,779 --> 00:28:53,450
with respect to seal and also the fact

602
00:28:59,590 --> 00:28:55,789
that the noise side is not irradiated

603
00:29:04,480 --> 00:28:59,600
like the dayside probably nathan is not

604
00:29:07,210 --> 00:29:04,490
so efficiently i destroyed this is just

605
00:29:09,430 --> 00:29:07,220
putting together the measurements in the

606
00:29:11,919 --> 00:29:09,440
near furet and the miller infrared and

607
00:29:14,169 --> 00:29:11,929
the agreement is actually very good and

608
00:29:16,149 --> 00:29:14,179
it was also at a bit of surprise because

609
00:29:18,909 --> 00:29:16,159
you were using two different instruments

610
00:29:21,340 --> 00:29:18,919
and while the three measurement in the

611
00:29:23,520 --> 00:29:21,350
meter infrared and separately the one in

612
00:29:25,990 --> 00:29:23,530
near-infrared were done simultaneously

613
00:29:27,820 --> 00:29:26,000

me to infer a tenure for that were

614
00:29:31,990 --> 00:29:27,830
knocked down simultaneously so we were

615
00:29:35,490 --> 00:29:32,000
expecting few more effects to play but

616
00:29:38,350 --> 00:29:35,500
they didn't seem to be very important

617
00:29:40,450 --> 00:29:38,360
now I'll show you before very briefly

618
00:29:45,850 --> 00:29:40,460
that one of the measurements in the

619
00:29:48,419 --> 00:29:45,860
visible by pawn it all showed a spectra

620
00:29:52,870 --> 00:29:48,429
that we're much more flat and so

621
00:29:56,649 --> 00:29:52,880
suggesting that we're Hayes's in the in

622
00:30:01,029 --> 00:29:56,659
the upper atmosphere of this planet what

623
00:30:03,190 --> 00:30:01,039
type of faces Howard is our Decatur

624
00:30:05,080 --> 00:30:03,200
istic of this particular clouds or

625
00:30:07,930 --> 00:30:05,090
Hayes's in this planet so how big Earl

626
00:30:09,730 --> 00:30:07,940
is particle how they are distributed is

627
00:30:12,789 --> 00:30:09,740
something that we would like to follow

628
00:30:17,080 --> 00:30:12,799
up and but in order to do so we need

629
00:30:19,899 --> 00:30:17,090
more measurement between one and more or

630
00:30:22,360 --> 00:30:19,909
less 1.6 micron which is exactly the

631
00:30:25,350 --> 00:30:22,370
area that at the moment is not probed

632
00:30:28,690 --> 00:30:25,360
because we would like to see this Pathan

633
00:30:30,340 --> 00:30:28,700
the part that is opaque before vases and

634
00:30:32,789 --> 00:30:30,350
the part of this conclusion is parent

635
00:30:35,649 --> 00:30:32,799
and i put here a very blurred

636
00:30:37,990 --> 00:30:35,659
unfortunately a figure that was taken

637
00:30:40,200 --> 00:30:38,000
from round two thousand one is as

638
00:30:41,970 --> 00:30:40,210

blurred as is probably

639
00:30:45,270 --> 00:30:41,980
if you look in the visible and

640
00:30:47,430 --> 00:30:45,280
atmosphere through some cases but this

641
00:30:49,740 --> 00:30:47,440
God just gives you the idea that if you

642
00:30:51,720 --> 00:30:49,750
play around with the particle size

643
00:30:54,060 --> 00:30:51,730
parameter you can get more than one

644
00:30:56,160 --> 00:30:54,070
situation and so we will need to have a

645
00:31:00,270 --> 00:30:56,170
little bit more data to understand what

646
00:31:02,520 --> 00:31:00,280
is going on on our planet that was

647
00:31:07,320 --> 00:31:02,530
particularly interested was interesting

648
00:31:09,780 --> 00:31:07,330
was HD 209 and this planet seems to show

649
00:31:12,900 --> 00:31:09,790
an emission a temperature inversion and

650
00:31:15,390 --> 00:31:12,910
again our few the planets we are

651
00:31:20,700 --> 00:31:15,400
probably right now but we are already

652
00:31:23,580 --> 00:31:20,710
showing a lot of variability let me come

653
00:31:25,950 --> 00:31:23,590
back to ht29 my favorite planet and

654
00:31:27,930 --> 00:31:25,960
there were new measurement coming out

655
00:31:30,660 --> 00:31:27,940
this year by the group of Charbonneau

656
00:31:33,780 --> 00:31:30,670
and the nukes and environment and this

657
00:31:38,070 --> 00:31:33,790
is the the dayside of the planet so what

658
00:31:39,900 --> 00:31:38,080
we did when we try to detect water and

659
00:31:42,510 --> 00:31:39,910
me thing we were probing the Terminator

660
00:31:44,760 --> 00:31:42,520
and the night side here is us back to

661
00:31:47,580 --> 00:31:44,770
the mission and they use a secondary

662
00:31:50,220 --> 00:31:47,590
transit photometry to do so and they're

663
00:31:52,530 --> 00:31:50,230

looking more at the day side and just

664
00:31:55,800 --> 00:31:52,540
from the photometry it looks like well

665
00:31:58,620 --> 00:31:55,810
water is there confirm but this seems to

666
00:32:01,020 --> 00:31:58,630
suggest that co is is present there and

667
00:32:05,490 --> 00:32:01,030
the reason they say so is very

668
00:32:07,650 --> 00:32:05,500
reasonable because a 4.5 micron that the

669
00:32:11,070 --> 00:32:07,660
photometry is actually the below that

670
00:32:15,180 --> 00:32:11,080
you would expect if co or not there what

671
00:32:18,270 --> 00:32:15,190
I can dissipate you is that after those

672
00:32:20,040 --> 00:32:18,280
paper we put together more observation

673
00:32:21,890 --> 00:32:20,050
always for the day side of this

674
00:32:26,550 --> 00:32:21,900
particular planet and we put together

675
00:32:29,220 --> 00:32:26,560
observation and emission always using

676
00:32:32,220 --> 00:32:29,230
Nick mos so near infrared have a

677
00:32:34,410 --> 00:32:32,230
measurements in spectroscopy in the

678
00:32:38,940 --> 00:32:34,420
mirror infrared and putting everything

679
00:32:41,190 --> 00:32:38,950
together we have now a new scenario that

680
00:32:42,690 --> 00:32:41,200
seems to suggest that that definitely

681
00:32:45,060 --> 00:32:42,700
the dayside of the planet is very

682
00:32:47,520 --> 00:32:45,070
different for in eyesight and it looks

683
00:32:50,130 --> 00:32:47,530
like in a day side of the planet for the

684
00:32:51,389 --> 00:32:50,140
chemistry play real a major role so is

685
00:32:53,459 --> 00:32:51,399
really going on

686
00:32:56,299 --> 00:32:53,469
the protection the photochemical

687
00:32:58,889 --> 00:32:56,309
prediction of models of years ago and

688
00:33:00,719 --> 00:32:58,899

this is an anticipation and I'm sorry

689
00:33:02,099 --> 00:33:00,729
that I cannot show you the dispatcher in

690
00:33:04,169 --> 00:33:02,109
just because it's very nice to meet you

691
00:33:07,259 --> 00:33:04,179
too nature so we have to be able to be

692
00:33:09,779 --> 00:33:07,269
careful but we seem to you to have a

693
00:33:13,440 --> 00:33:09,789
strong suggestion that co2 is there and

694
00:33:17,909 --> 00:33:13,450
possibly as yet so there will be more

695
00:33:21,209 --> 00:33:17,919
stuff come in very soon I hope so what's

696
00:33:23,399 --> 00:33:21,219
next because I just show you interesting

697
00:33:25,529 --> 00:33:23,409
planet but probably not that interesting

698
00:33:29,729 --> 00:33:25,539
in terms of availability these are

699
00:33:32,549 --> 00:33:29,739
health so certainly life I guess is not

700
00:33:35,219 --> 00:33:32,559
very happy to leave on hot Jupiters so

701
00:33:36,989 --> 00:33:35,229
what next is to try to use the same kind

702
00:33:39,149 --> 00:33:36,999
of technique and what we're learning

703
00:33:42,119 --> 00:33:39,159
right now on these hot Jupiters to

704
00:33:45,359 --> 00:33:42,129
choose morris ice planet and what we can

705
00:33:48,599 --> 00:33:45,369
do right now today is a Neptune size

706
00:33:51,359 --> 00:33:48,609
button for instance Gliese 436 B has

707
00:33:54,239 --> 00:33:51,369
already been proud I with Spitzer by the

708
00:33:56,009 --> 00:33:54,249
group of diming and I can tell you that

709
00:33:59,339 --> 00:33:56,019
there are several observation that we're

710
00:34:01,649 --> 00:33:59,349
given to different groups to probe this

711
00:34:03,749 --> 00:34:01,659
planet in every possible way with every

712
00:34:06,359 --> 00:34:03,759
possible instrument so in few months we

713
00:34:11,180 --> 00:34:06,369

will know a lot about what is going on

714
00:34:14,010 --> 00:34:11,190
at least on one example of hot napkins

715
00:34:18,319 --> 00:34:14,020
border into the future unfortunately

716
00:34:23,369 --> 00:34:18,329
probably Spitzer will we lose is a

717
00:34:26,369 --> 00:34:23,379
cryogenic capability and so war Spitzer

718
00:34:29,819 --> 00:34:26,379
probably will stay alive and we warned

719
00:34:33,869 --> 00:34:29,829
Spitzer with we will be able to still

720
00:34:36,899 --> 00:34:33,879
use part of the era camera the band of

721
00:34:38,869 --> 00:34:36,909
3.6 and 4.4 still okay even for one

722
00:34:41,129 --> 00:34:38,879
Spitzer so this is definitely a

723
00:34:43,740 --> 00:34:41,139
telescope we are not losing for the

724
00:34:45,569 --> 00:34:43,750
moment which is great further into the

725
00:34:48,629 --> 00:34:45,579
future we will have this new generation

726
00:34:51,089 --> 00:34:48,639
of space telescope to change webb space

727
00:34:52,589 --> 00:34:51,099
telescope in particular and right now

728
00:34:55,379 --> 00:34:52,599
there are solar groups that are already

729
00:34:58,559 --> 00:34:55,389
making simulation and calculation to see

730
00:35:01,829 --> 00:34:58,569
what we can do with this fantastic toy

731
00:35:04,440 --> 00:35:01,839
and i can tell you that at least in

732
00:35:07,740 --> 00:35:04,450
primary transit we can already do

733
00:35:10,260 --> 00:35:07,750
sighs Barnett and this is part of work

734
00:35:14,160 --> 00:35:10,270
we are doing with Tony baccala team

735
00:35:15,900 --> 00:35:14,170
Paris and stewed in Cairo rock and there

736
00:35:18,540 --> 00:35:15,910
are many other groups that are doing

737
00:35:21,660 --> 00:35:18,550
similar calculation and also looking

738
00:35:24,180 --> 00:35:21,670

into the possibility of looking at super

739
00:35:26,280 --> 00:35:24,190
birth doing secondary transit which a

740
00:35:30,000 --> 00:35:26,290
Douglas TJ CC will have an incredible

741
00:35:32,910 --> 00:35:30,010
sensitivity so we are definitely able to

742
00:35:34,200 --> 00:35:32,920
probe more interesting planet there are

743
00:35:38,040 --> 00:35:34,210
more interesting in terms of

744
00:35:42,839 --> 00:35:38,050
availability another interesting

745
00:35:45,390 --> 00:35:42,849
instrument that might help us if is if

746
00:35:48,300 --> 00:35:45,400
it will be launched is a jaksa is a

747
00:35:51,870 --> 00:35:48,310
mission called Spica is a sort of new

748
00:35:56,040 --> 00:35:51,880
generation of pizza and it would be

749
00:35:58,890 --> 00:35:56,050
cooled at 50 Cal vain and so this could

750
00:36:02,900 --> 00:35:58,900
provide a very high sensitivity in very

751
00:36:05,010 --> 00:36:02,910
high spectral resolution Japanese are

752
00:36:06,990 --> 00:36:05,020
trying to see if they can put a

753
00:36:09,599 --> 00:36:07,000
coronagraph and one of the instruments

754
00:36:12,990 --> 00:36:09,609
so potentially they could also do a

755
00:36:16,349 --> 00:36:13,000
little bit of direct detection so very

756
00:36:18,319 --> 00:36:16,359
interesting instrument so to conclude

757
00:36:21,300 --> 00:36:18,329
about the part about primary a secondary

758
00:36:24,089 --> 00:36:21,310
transit technique using box with raman

759
00:36:27,270 --> 00:36:24,099
spectroscopy this technique are probable

760
00:36:30,480 --> 00:36:27,280
to be extremely powerful because I mean

761
00:36:32,970 --> 00:36:30,490
I just show you most recent result using

762
00:36:37,440 --> 00:36:32,980
this technique and how many things were

763
00:36:38,849 --> 00:36:37,450

to do you can dismantle and something

764
00:36:42,599 --> 00:36:38,859
that I realized actually putting

765
00:36:45,270 --> 00:36:42,609
together a similar talk for the Boston

766
00:36:48,000 --> 00:36:45,280
Museum transiting planet lightweight was

767
00:36:51,900 --> 00:36:48,010
actually we are already approaching the

768
00:36:54,300 --> 00:36:51,910
level of knowledge that was reached with

769
00:36:56,670 --> 00:36:54,310
Voyager 1 for the solar system the kind

770
00:36:58,349 --> 00:36:56,680
of question we are asking right now the

771
00:37:01,260 --> 00:36:58,359
counter detection we are doing is not

772
00:37:03,059 --> 00:37:01,270
that the different from those ears so I

773
00:37:07,740 --> 00:37:03,069
really thing that the excess oil pan

774
00:37:10,650 --> 00:37:07,750
field has really rich and really high

775
00:37:14,180 --> 00:37:10,660
level of sophistication at the moment

776
00:37:15,680 --> 00:37:14,190
and certainly even if I told you that

777
00:37:18,050 --> 00:37:15,690
using

778
00:37:19,790 --> 00:37:18,060
it's petroleum photometer technique is

779
00:37:22,819 --> 00:37:19,800
wonderful because you can do a lot of

780
00:37:24,680 --> 00:37:22,829
things socially for planets with larger

781
00:37:29,180 --> 00:37:24,690
separation from the stall so they are

782
00:37:31,579 --> 00:37:29,190
not orbiting very close they are not so

783
00:37:33,950 --> 00:37:31,589
practical and for those planet

784
00:37:36,260 --> 00:37:33,960
definitely you need to think in terms of

785
00:37:38,510 --> 00:37:36,270
direct detection and so this is more a

786
00:37:41,240 --> 00:37:38,520
message for the for the future that we

787
00:37:43,430 --> 00:37:41,250
all hope there will be a near future so

788
00:37:47,270 --> 00:37:43,440

the idea with direct detection is that

789
00:37:49,099 --> 00:37:47,280
you you try to take out the contribution

790
00:37:52,640 --> 00:37:49,109
of the star and concentrate on the

791
00:37:55,160 --> 00:37:52,650
planet alone on the contrary with

792
00:37:57,530 --> 00:37:55,170
transit technique you always have to put

793
00:38:01,329 --> 00:37:57,540
together the package star and planet so

794
00:38:04,460 --> 00:38:01,339
it's a sort of different way of thinking

795
00:38:06,349 --> 00:38:04,470
during dissection is obviously not easy

796
00:38:11,270 --> 00:38:06,359
and that's why Liz take a little bit of

797
00:38:13,370 --> 00:38:11,280
time to be implemented because if you

798
00:38:16,849 --> 00:38:13,380
look at the planet in the visible or in

799
00:38:19,430 --> 00:38:16,859
the infrared for each fault ins that is

800
00:38:22,309 --> 00:38:19,440
coming out of the planet you need to get

801
00:38:24,500 --> 00:38:22,319
read a temporary 9 or temporary 6 photos

802
00:38:26,839 --> 00:38:24,510
depending which mainly looking at and

803
00:38:29,359 --> 00:38:26,849
what is the size of the planet but this

804
00:38:31,790 --> 00:38:29,369
number of aches and so definitely that

805
00:38:34,910 --> 00:38:31,800
the techniques are there but it's

806
00:38:36,710 --> 00:38:34,920
certainly not an easy an easy job there

807
00:38:39,200 --> 00:38:36,720
are the law at the moment a lot of

808
00:38:43,819 --> 00:38:39,210
mission concept they are considerate for

809
00:38:47,660 --> 00:38:43,829
studies both in US or in Europe using

810
00:38:52,910 --> 00:38:47,670
for instance more or less big size

811
00:38:55,099 --> 00:38:52,920
telescope and coronagraphs if you use a

812
00:38:57,980 --> 00:38:55,109
small size the telescope definitely

813
00:39:02,540 --> 00:38:57,990

you're not able to do her size but if

814
00:39:04,730 --> 00:39:02,550
you are most able to do super but there

815
00:39:07,579 --> 00:39:04,740
are also new concept that on the

816
00:39:09,859 --> 00:39:07,589
contrary are probably more a planned to

817
00:39:13,099 --> 00:39:09,869
do really ice planet in the habitable

818
00:39:14,990 --> 00:39:13,109
zone one of those is the new word

819
00:39:17,780 --> 00:39:15,000
observer the mission that was proposed

820
00:39:19,940 --> 00:39:17,790
by reverse the cash and this is

821
00:39:23,000 --> 00:39:19,950
certainly a large class except on a

822
00:39:25,860 --> 00:39:23,010
mission and the entire idea is that you

823
00:39:30,810 --> 00:39:25,870
have a deployable mask

824
00:39:34,380 --> 00:39:30,820
that is a cool teen and the starshade is

825
00:39:38,130 --> 00:39:34,390
separated by the telescope and with this

826
00:39:40,590 --> 00:39:38,140
kind of technique from simulation you

827
00:39:44,390 --> 00:39:40,600
can see these are basically a simulation

828
00:39:47,850 --> 00:39:44,400
of our own solar system how you would

829
00:39:51,140 --> 00:39:47,860
detect it if you wear ten parsecs away

830
00:39:54,150 --> 00:39:51,150
and as you can see from the simulation

831
00:39:56,550 --> 00:39:54,160
with a four meter telescope you could

832
00:40:01,110 --> 00:39:56,560
potentially be able to probe Earth and

833
00:40:03,330 --> 00:40:01,120
Venus these are the basically the the

834
00:40:10,220 --> 00:40:03,340
planets is likely blue and slightly

835
00:40:15,300 --> 00:40:12,570
also from the ground that there are

836
00:40:17,790 --> 00:40:15,310
several efforts in terms of building new

837
00:40:21,240 --> 00:40:17,800
instruments and very large a telescope

838
00:40:23,940 --> 00:40:21,250

and a technique to separate the light of

839
00:40:26,520 --> 00:40:23,950
the star in the planet I'm just citing

840
00:40:28,200 --> 00:40:26,530
this initiative from either but I'm sure

841
00:40:30,780 --> 00:40:28,210
also in the in the u.s. there is a

842
00:40:33,120 --> 00:40:30,790
similar initiative is just that I'm not

843
00:40:36,180 --> 00:40:33,130
completely aware of that and for

844
00:40:38,070 --> 00:40:36,190
instance easel is planning these

845
00:40:41,300 --> 00:40:38,080
extremely large telescope which at the

846
00:40:44,730 --> 00:40:41,310
moment is about 32 meter diameter and

847
00:40:46,920 --> 00:40:44,740
the idea is to implement some ice cream

848
00:40:48,390 --> 00:40:46,930
adaptive optics to get rid of some of

849
00:40:54,900 --> 00:40:48,400
the contribution of the earth atmosphere

850
00:41:00,210 --> 00:40:54,910
and using probably choreography and also

851
00:41:04,080 --> 00:41:00,220
polarimetry to characterize excess oil

852
00:41:07,590 --> 00:41:04,090
planet up to the earth sized level so

853
00:41:11,100 --> 00:41:07,600
let me close my seminar here I would

854
00:41:14,490 --> 00:41:11,110
first of all like to thank you all for

855
00:41:18,620 --> 00:41:14,500
having participated and I would like to

856
00:41:20,790 --> 00:41:18,630
thank also my collaborator because

857
00:41:22,890 --> 00:41:20,800
certainly they already wonder is doing

858
00:41:27,510 --> 00:41:22,900
the top job in a reducing most of the

859
00:41:30,510 --> 00:41:27,520
data and I would like to leave on the

860
00:41:34,050 --> 00:41:30,520
contrary more time for question if you

861
00:41:37,339 --> 00:41:34,060
have any and before I give you the ipad

862
00:41:41,509 --> 00:41:37,349
to the floor an announcement

863
00:41:43,549 --> 00:41:41,519

our planet is meeting in Paris the title

864
00:41:46,640 --> 00:41:43,559
will be molecule in the atmospheric

865
00:41:49,160 --> 00:41:46,650
sasural planets and it is to bring

866
00:41:51,049 --> 00:41:49,170
together different communities access or

867
00:41:52,989 --> 00:41:51,059
planning community but also the solar

868
00:41:57,229 --> 00:41:52,999
system community brown dwarf

869
00:42:00,200 --> 00:41:57,239
astrobiology instrument community and

870
00:42:03,319 --> 00:42:00,210
the idea would be to share information

871
00:42:05,420 --> 00:42:03,329
but also to see a little bit more clear

872
00:42:07,249 --> 00:42:05,430
how bright can be our future in this

873
00:42:14,539 --> 00:42:07,259
field thank you so much for your

874
00:42:18,410 --> 00:42:14,549
attention thank you very much Giovanna

875
00:42:20,299 --> 00:42:18,420
for great seminar with anybody who has

876
00:42:22,969 --> 00:42:20,309
questions please raise their hand in

877
00:42:25,249 --> 00:42:22,979
WebEx and I'll give you a couple of

878
00:42:27,859 --> 00:42:25,259
minutes to do that and I'll just take

879
00:42:29,870 --> 00:42:27,869
advantage of this moment for another

880
00:42:32,630 --> 00:42:29,880
announcement and that is that we will

881
00:42:35,329 --> 00:42:32,640
probably have one more director seminar

882
00:42:38,539 --> 00:42:35,339
this year before the director seminar

883
00:42:40,759 --> 00:42:38,549
goes on vacation for the summer and I

884
00:42:43,339 --> 00:42:40,769
don't think we've confirmed the speaker

885
00:42:47,569 --> 00:42:43,349
for the final one but it will be on

886
00:42:50,299 --> 00:42:47,579
Monday June thirtieth I have that date

887
00:42:53,150 --> 00:42:50,309
correct yeah Monday June thirtieth and

888
00:42:56,150 --> 00:42:53,160

then the director seminar series will

889
00:42:59,299 --> 00:42:56,160
pick up again in September at the end of

890
00:43:01,670 --> 00:42:59,309
September with norm sleep picking up

891
00:43:04,069 --> 00:43:01,680
with this very topic and telling us

892
00:43:07,339 --> 00:43:04,079
about the habitability of super Earths

893
00:43:09,049 --> 00:43:07,349
and I'll take advantage of having the

894
00:43:11,749 --> 00:43:09,059
floor in the open microphone for the

895
00:43:14,420 --> 00:43:11,759
moment to ask giovanna question I found

896
00:43:17,209 --> 00:43:14,430
your mass radius chart it was like the

897
00:43:20,509 --> 00:43:17,219
3rd slide that you showed very

898
00:43:22,819 --> 00:43:20,519
interesting one of the challenges of

899
00:43:26,719 --> 00:43:22,829
course is going to be to tell the

900
00:43:30,799 --> 00:43:26,729
difference between a 5 earth maths super

901
00:43:34,910 --> 00:43:30,809
earth and a 5 earth-mass miniature

902
00:43:36,529 --> 00:43:34,920
Neptune how did how easily do you think

903
00:43:38,989 --> 00:43:36,539
or how hard do you think it's going to

904
00:43:42,410 --> 00:43:38,999
be to tell the difference between those

905
00:43:45,140 --> 00:43:42,420
two will the mass radius relationship be

906
00:43:46,940 --> 00:43:45,150
the key do you think the molecular

907
00:43:48,799 --> 00:43:46,950
species in the atmosphere will be the

908
00:43:50,060 --> 00:43:48,809
key and and how well do you think the

909
00:43:52,310 --> 00:43:50,070
tools were going to have let's

910
00:43:54,170 --> 00:43:52,320
say in the next 5-10 years to approach

911
00:43:56,000 --> 00:43:54,180
that question how effective you think

912
00:43:58,850 --> 00:43:56,010
they're going to be well this is a very

913
00:44:01,610 --> 00:43:58,860

good question actually well first of all

914
00:44:03,560 --> 00:44:01,620
since we are assuming that we know the

915
00:44:05,180 --> 00:44:03,570
mass in the radios will probably also

916
00:44:08,120 --> 00:44:05,190
sue me we're looking at transiting

917
00:44:12,350 --> 00:44:08,130
planet so let put us in a situation that

918
00:44:15,590 --> 00:44:12,360
in the easiest situation so I would say

919
00:44:18,830 --> 00:44:15,600
we can definitely understand if it is a

920
00:44:22,510 --> 00:44:18,840
terrestrial rocky planet or an F on it

921
00:44:25,460 --> 00:44:22,520
just by using primary transit technique

922
00:44:27,800 --> 00:44:25,470
for the atmosphere so if you have a

923
00:44:29,870 --> 00:44:27,810
telescope like Hubble or spit or for

924
00:44:32,480 --> 00:44:29,880
instance or next generation of space

925
00:44:35,060 --> 00:44:32,490
telescope for which we can reach that

926
00:44:37,400 --> 00:44:35,070
level of detail definitely we can see

927
00:44:41,660 --> 00:44:37,410
what is going on because if it is an app

928
00:44:44,270 --> 00:44:41,670
to Planet what we imagine is that napkin

929
00:44:46,760 --> 00:44:44,280
planet is is a made of a lot of origin

930
00:44:49,430 --> 00:44:46,770
still so meaning with that that the

931
00:44:52,490 --> 00:44:49,440
angles bear is still very extended and

932
00:44:55,400 --> 00:44:52,500
so what am I specting is that from an

933
00:44:58,010 --> 00:44:55,410
émigré point of view in transmission you

934
00:45:00,710 --> 00:44:58,020
can really get a very nice signature of

935
00:45:02,720 --> 00:45:00,720
what is going on on the contrary if you

936
00:45:04,940 --> 00:45:02,730
have a rocky planet or that mass in

937
00:45:07,070 --> 00:45:04,950
primary transit I am predicting they

938
00:45:09,320 --> 00:45:07,080

were not seen anything and the reason

939
00:45:12,320 --> 00:45:09,330
for this is that in primary transit

940
00:45:14,720 --> 00:45:12,330
technique what is happening since you're

941
00:45:16,610 --> 00:45:14,730
really probing and I'm most feared and

942
00:45:20,060 --> 00:45:16,620
you need something very extended for

943
00:45:21,980 --> 00:45:20,070
that for a rocky planet the youngest

944
00:45:25,940 --> 00:45:21,990
fear is supposed to be much more compact

945
00:45:28,310 --> 00:45:25,950
and so I guess that at that level look

946
00:45:30,980 --> 00:45:28,320
interests of the presence of signatures

947
00:45:35,240 --> 00:45:30,990
or non signature from the atmospheres

948
00:45:43,370 --> 00:45:38,590
and we have a question from Tom Green

949
00:45:44,660 --> 00:45:43,380
hello I'd like to second I guess Carl's

950
00:45:47,390 --> 00:45:44,670
comments about this really being an

951
00:45:50,090 --> 00:45:47,400
excellent talk just a minor comment is

952
00:45:52,100 --> 00:45:50,100
that I certainly agree JD BST is going

953
00:45:54,290 --> 00:45:52,110
to be a very powerful Observatory for

954
00:45:57,230 --> 00:45:54,300
this it'll have some good capabilities

955
00:45:59,870 --> 00:45:57,240
we think that we'll be able to get a

956
00:46:01,730 --> 00:45:59,880
pretty high quality spectra like better

957
00:46:07,010 --> 00:46:01,740
than IRS and hopefully better than Nick

958
00:46:11,810 --> 00:46:07,020
moss from let's say at least 2.5 microns

959
00:46:14,120 --> 00:46:11,820
how 20 at least 13 microns and you know

960
00:46:17,120 --> 00:46:14,130
it may be spectra on both sides of that

961
00:46:19,300 --> 00:46:17,130
as well however you know the instrument

962
00:46:22,450 --> 00:46:19,310
teams have been looking into this and

963
00:46:26,750 --> 00:46:22,460

it's probably not going to be getting

964
00:46:29,630 --> 00:46:26,760
secondary eclipse spectra of anything

965
00:46:31,940 --> 00:46:29,640
close to nurse eyes even even around an

966
00:46:34,940 --> 00:46:31,950
M star but for larger planets it's going

967
00:46:38,300 --> 00:46:34,950
to do really well so that was just a

968
00:46:40,820 --> 00:46:38,310
comment actually we could do earth-sized

969
00:46:43,340 --> 00:46:40,830
planets around small stars but it'd be

970
00:46:46,670 --> 00:46:43,350
much warmer than ones in habitable zones

971
00:46:49,370 --> 00:46:46,680
so that's that's the only comment now I

972
00:46:52,010 --> 00:46:49,380
agree when I was talking about her sighs

973
00:46:54,470 --> 00:46:52,020
I was talking about primary transit not

974
00:46:56,990 --> 00:46:54,480
really secondary Yeah right we may be

975
00:46:58,700 --> 00:46:57,000
able to get them yeah I mean of course

976
00:47:00,800 --> 00:46:58,710
it depends also on the brightness of the

977
00:47:04,430 --> 00:47:00,810
star we're definitely talking about a

978
00:47:07,130 --> 00:47:04,440
most favorable target not for all of

979
00:47:14,449 --> 00:47:07,140
them but it seems to be the numbers are

980
00:47:20,519 --> 00:47:18,359
and the other questions if there are no

981
00:47:22,469 --> 00:47:20,529
other hands raised on webex so if you

982
00:47:28,140 --> 00:47:22,479
have a question we'd like to just jump

983
00:47:31,979 --> 00:47:28,150
in this is an opportunity um there's a

984
00:47:34,920 --> 00:47:31,989
question of got it go ahead got it um I

985
00:47:36,930 --> 00:47:34,930
had a question about your CEO and water

986
00:47:39,660 --> 00:47:36,940
measurements and methane measurements I

987
00:47:43,680 --> 00:47:39,670
don't know if you if your abundances or

988
00:47:46,859 --> 00:47:43,690

our errors are small enough to get a CTO

989
00:47:48,690 --> 00:47:46,869
ratio that is meaningful out of those

990
00:47:52,920 --> 00:47:48,700
observations and how it compares to our

991
00:47:56,150 --> 00:47:52,930
own system for other other interstellar

992
00:47:58,410 --> 00:47:56,160
values that we know for sudo ratios

993
00:48:01,769 --> 00:47:58,420
that's were a good question this was

994
00:48:05,130 --> 00:48:01,779
exactly where we wanted to go somehow

995
00:48:08,039 --> 00:48:05,140
now in from the measurement in primary

996
00:48:11,670 --> 00:48:08,049
transit and in particular from the

997
00:48:14,549 --> 00:48:11,680
observation of Nick bus in primary it

998
00:48:17,999 --> 00:48:14,559
was actually tufted to give asea ratio

999
00:48:20,880 --> 00:48:18,009
and the reason for that is that the the

1000
00:48:22,920 --> 00:48:20,890
signature of methane could potentially

1001
00:48:26,489 --> 00:48:22,930
mask the presence of the signature of

1002
00:48:29,459 --> 00:48:26,499
seal and so we could the satin upper

1003
00:48:32,459 --> 00:48:29,469
limit on the CEO abundance but just

1004
00:48:34,920 --> 00:48:32,469
another limit so at the moment on in

1005
00:48:37,650 --> 00:48:34,930
primary meaning that meaning with that

1006
00:48:40,739 --> 00:48:37,660
the Terminator and potentially no sides

1007
00:48:43,609 --> 00:48:40,749
and we are not able really to to settle

1008
00:48:46,829 --> 00:48:43,619
limit on the sea or Asia but what I can

1009
00:48:49,380 --> 00:48:46,839
sort of can anticipate to you is that

1010
00:48:52,939 --> 00:48:49,390
this new paper that we submitted for the

1011
00:48:57,029 --> 00:48:52,949
emission spectrum day on the day side

1012
00:48:58,829 --> 00:48:57,039
since in that case we were able to put

1013
00:49:01,799 --> 00:48:58,839

together a lot of measurement from the

1014
00:49:05,819 --> 00:49:01,809
newer infrared to the far infrared and

1015
00:49:08,099 --> 00:49:05,829
holstein spectroscopy in that case we

1016
00:49:10,949 --> 00:49:08,109
could be a little bit more specific and

1017
00:49:13,289 --> 00:49:10,959
there seems to be indication and again

1018
00:49:15,989 --> 00:49:13,299
take it for the moment as a preliminary

1019
00:49:17,969 --> 00:49:15,999
thing because of people is being read

1020
00:49:20,329 --> 00:49:17,979
the paper is being afraid at the moment

1021
00:49:22,920 --> 00:49:20,339
but it really looks like for

1022
00:49:26,249 --> 00:49:22,930
interpreting well the spectra the

1023
00:49:29,549 --> 00:49:26,259
spectrum in the mission you need to have

1024
00:49:36,959 --> 00:49:29,559
a seizure a as seems to go towards

1025
00:49:38,370 --> 00:49:36,969
the carbon enrichment on on a mission we

1026
00:49:41,640 --> 00:49:38,380
were able to be a little bit more

1027
00:49:45,479 --> 00:49:41,650
specific and especially because they

1028
00:49:50,670 --> 00:49:45,489
were species like co2 that can be used

1029
00:49:52,859 --> 00:49:50,680
as a proxy of the presence of CEO how

1030
00:49:56,279 --> 00:49:52,869
large were the uncertainties on that I

1031
00:49:59,370 --> 00:49:56,289
mean was it within earth within solar

1032
00:50:02,910 --> 00:49:59,380
range or a farm or beyond that in to

1033
00:50:04,499 --> 00:50:02,920
Sigma 3 Sigma well again I would be just

1034
00:50:07,650 --> 00:50:04,509
a little bit careful because of course

1035
00:50:10,349 --> 00:50:07,660
there are aerobars so I I mean probably

1036
00:50:13,079 --> 00:50:10,359
not very comfortable and setting in a

1037
00:50:15,390 --> 00:50:13,089
number I'm just telling you is it there

1038
00:50:18,390 --> 00:50:15,400

is a very strong suggestion that there

1039
00:50:26,660 --> 00:50:18,400
is a carbon enrichment I would just stay

1040
00:50:30,870 --> 00:50:29,400
hi I'm you talked about primary and

1041
00:50:32,729 --> 00:50:30,880
secondary transits and I was just

1042
00:50:34,739 --> 00:50:32,739
wondering when you observe a transit how

1043
00:50:39,809 --> 00:50:34,749
can tell which type of transit you're

1044
00:50:43,529 --> 00:50:39,819
observing well well basically when you

1045
00:50:47,609 --> 00:50:43,539
plan your observation you you plan

1046
00:50:51,269 --> 00:50:47,619
exactly what you are doing so in the

1047
00:50:55,319 --> 00:50:51,279
case again of primary you basically

1048
00:50:58,349 --> 00:50:55,329
observe basically when the planet is

1049
00:51:00,089 --> 00:50:58,359
passing in front of the star and so you

1050
00:51:02,430 --> 00:51:00,099
measure before when there is no

1051
00:51:04,289 --> 00:51:02,440
transistors that the sort of star alone

1052
00:51:06,870 --> 00:51:04,299
and then when the planet is passing in

1053
00:51:08,819 --> 00:51:06,880
front of it and the case of secondary

1054
00:51:21,900 --> 00:51:08,829
have to plan your observation in a

1055
00:51:32,730 --> 00:51:25,740
do we have any other questions any here

1056
00:51:39,770 --> 00:51:32,740
in nai central look there no further