
AB
GRAD
CON23

1
00:00:13,490 --> 00:00:10,690
[Music]

2
00:00:15,169 --> 00:00:13,500
all right Hi I'm Evelyn I'm a PhD

3
00:00:16,369 --> 00:00:15,179
candidate at the University of Toronto

4
00:00:17,930 --> 00:00:16,379
and I'd like to talk about some

5
00:00:20,450 --> 00:00:17,940
simulation work that I've been doing

6
00:00:21,710 --> 00:00:20,460
with my collaborators they're funded by

7
00:00:25,250 --> 00:00:21,720
answer

8
00:00:27,550 --> 00:00:25,260
so I work on Emirates which for the

9
00:00:30,830 --> 00:00:27,560
purposes of this talk I'm defining as

10
00:00:33,590 --> 00:00:30,840
roughly earth-sized rocky planets in the

11
00:00:36,110 --> 00:00:33,600
habitable zone of an M dwarf star and so

12
00:00:37,370 --> 00:00:36,120
because because the star is small the

13
00:00:39,590 --> 00:00:37,380

planet is close to the Stars so we

14
00:00:42,709 --> 00:00:39,600
assume it's totally locked

15
00:00:45,049 --> 00:00:42,719
um so this this diagram over here just

16
00:00:48,590 --> 00:00:45,059
kind of shows what that looks like

17
00:00:50,450 --> 00:00:48,600
so we have the Stars somewhere over here

18
00:00:52,430 --> 00:00:50,460
um light from the Star hitting the

19
00:00:53,569 --> 00:00:52,440
planet at the substellar point which is

20
00:00:54,889 --> 00:00:53,579
always at the same place because the

21
00:00:58,130 --> 00:00:54,899
planet has a permanent day and night

22
00:00:59,750 --> 00:00:58,140
side and the Terminator is kind of a

23
00:01:01,610 --> 00:00:59,760
cool word for the dividing line between

24
00:01:03,410 --> 00:01:01,620
the day side and the night side so just

25
00:01:04,969 --> 00:01:03,420
kind of keep that in mind I'll be using

26
00:01:06,890 --> 00:01:04,979
some of these terms

27
00:01:08,630 --> 00:01:06,900
now the base assumption is that these

28
00:01:13,130 --> 00:01:08,640
planets have what we call an eyeball

29
00:01:14,210 --> 00:01:13,140
climate so again we have the star here

30
00:01:17,090 --> 00:01:14,220
um the assumption is that the night side

31
00:01:19,310 --> 00:01:17,100
is frozen and part of the day side is

32
00:01:21,170 --> 00:01:19,320
unfrozen near the sub Stellar point

33
00:01:22,850 --> 00:01:21,180
where it receives the most radiation and

34
00:01:25,190 --> 00:01:22,860
you would assume that's a circle this is

35
00:01:28,310 --> 00:01:25,200
actually an oversimplification but it's

36
00:01:29,690 --> 00:01:28,320
kind of a good starting point

37
00:01:32,149 --> 00:01:29,700
so

38
00:01:33,770 --> 00:01:32,159

I have a few questions that I'd like to

39
00:01:35,569 --> 00:01:33,780
be trying to answer today

40
00:01:38,210 --> 00:01:35,579
first of all how does land configuration

41
00:01:39,410 --> 00:01:38,220
affect Emirates climates how does the

42
00:01:42,170 --> 00:01:39,420
mass of the atmosphere affect their

43
00:01:44,510 --> 00:01:42,180
climates I'll be answering those using a

44
00:01:48,289 --> 00:01:44,520
3D GCM General circulation model called

45
00:01:49,670 --> 00:01:48,299
exoplasm and then the next part is can

46
00:01:51,830 --> 00:01:49,680
we tell these climates apart and

47
00:01:54,649 --> 00:01:51,840
observations I'll be using a radiative

48
00:01:58,429 --> 00:01:54,659
transfer model based on my exoplasm

49
00:02:02,929 --> 00:02:00,950
so to start I like to talk about land

50
00:02:05,270 --> 00:02:02,939
configuration

51
00:02:07,429 --> 00:02:05,280
and so if the recall the eyeball climate

52
00:02:10,850 --> 00:02:07,439
we kind of have a cartoon of this here

53
00:02:13,910 --> 00:02:10,860
the idea is what happens if we put land

54
00:02:16,010 --> 00:02:13,920
in that warm deglaciated region because

55
00:02:17,150 --> 00:02:16,020
that's the region that's probably the

56
00:02:19,910 --> 00:02:17,160
most interesting

57
00:02:20,630 --> 00:02:19,920
but what's going on in the surface there

58
00:02:26,330 --> 00:02:20,640
um

59
00:02:27,170 --> 00:02:26,340
so I've done this in a systematic way

60
00:02:29,150 --> 00:02:27,180
um

61
00:02:31,970 --> 00:02:29,160
as I'm showing over here

62
00:02:34,430 --> 00:02:31,980
basically we have two opposite content

63
00:02:36,110 --> 00:02:34,440

configurations where either all of the

64
00:02:37,910 --> 00:02:36,120
land is in a circle at the substellar

65
00:02:40,790 --> 00:02:37,920
point so that's the substellar continent

66
00:02:44,210 --> 00:02:40,800
over here with ocean everywhere else and

67
00:02:46,610 --> 00:02:44,220
if if the ocean is cold there's ice

68
00:02:49,009 --> 00:02:46,620
instead of open water and then the

69
00:02:51,050 --> 00:02:49,019
opposite substellar ocean putting land

70
00:02:53,869 --> 00:02:51,060
everywhere except for a circle at the

71
00:02:54,530 --> 00:02:53,879
substellar point where there's water

72
00:02:56,570 --> 00:02:54,540
um

73
00:02:58,910 --> 00:02:56,580
and we vary the size of the circle in

74
00:03:01,910 --> 00:02:58,920
all of these simulations going from zero

75
00:03:03,830 --> 00:03:01,920
to a hundred percent so

76
00:03:06,170 --> 00:03:03,840
here you can see that sometimes there's

77
00:03:07,610 --> 00:03:06,180
ice-free ocean and sometimes there's not

78
00:03:12,170 --> 00:03:07,620
and these ones there's always some ice

79
00:03:17,449 --> 00:03:14,030
so now what what happens to the climate

80
00:03:19,490 --> 00:03:17,459
when we run the climate model with these

81
00:03:22,369 --> 00:03:19,500
there's a lot going on here so let's

82
00:03:23,809 --> 00:03:22,379
let's just take it slowly on the on the

83
00:03:27,649 --> 00:03:23,819
left here we have substellar continent

84
00:03:30,850 --> 00:03:27,659
models with different land fractions

85
00:03:32,869 --> 00:03:30,860
so this First Column is the land map

86
00:03:34,369 --> 00:03:32,879
just looking straight down at the center

87
00:03:35,750 --> 00:03:34,379
of the day side with the night side not

88
00:03:36,470 --> 00:03:35,760

shown

89
00:03:40,789 --> 00:03:36,480
um

90
00:03:43,309 --> 00:03:40,799
precipitation and evaporation so red is

91
00:03:46,070 --> 00:03:43,319
evaporation blue is precipitation you'll

92
00:03:47,690 --> 00:03:46,080
notice it always rains at the substellar

93
00:03:49,729 --> 00:03:47,700
point and water evaporates from the

94
00:03:52,009 --> 00:03:49,739
ocean everywhere else on the day side

95
00:03:54,229 --> 00:03:52,019
and this is true for these ones these

96
00:03:56,330 --> 00:03:54,239
substellar Ocean Models as well you get

97
00:03:57,850 --> 00:03:56,340
clouds and precipitation in the middle

98
00:04:00,350 --> 00:03:57,860
of the day side and over ocean

99
00:04:03,890 --> 00:04:00,360
regardless of where the land is

100
00:04:06,170 --> 00:04:03,900
so the water comes toward the center of

101
00:04:08,570 --> 00:04:06,180
the planet where it's warmest Rises it

102
00:04:10,850 --> 00:04:08,580
condenses out and you get rain

103
00:04:16,009 --> 00:04:10,860
so

104
00:04:18,469 --> 00:04:16,019
temperatures depending on how much land

105
00:04:20,750 --> 00:04:18,479
there is with high land fraction planets

106
00:04:22,490 --> 00:04:20,760
having hot and dry day sides which is

107
00:04:23,749 --> 00:04:22,500
what's shown in this column here so

108
00:04:25,610 --> 00:04:23,759
these are some pretty significant

109
00:04:27,590 --> 00:04:25,620
climate differences

110
00:04:30,409 --> 00:04:27,600
um

111
00:04:32,810 --> 00:04:30,419
like on a spatially resolved level this

112
00:04:35,030 --> 00:04:32,820
is what this looks like globally on the

113
00:04:38,350 --> 00:04:35,040

x-axis we have dayside land fraction so

114
00:04:40,790 --> 00:04:38,360
the size of of the circle for these two

115
00:04:42,710 --> 00:04:40,800
landmap types and on the y-axis we have

116
00:04:44,270 --> 00:04:42,720
temperature on the left and water vapor

117
00:04:46,189 --> 00:04:44,280
on the right

118
00:04:47,749 --> 00:04:46,199
um you'll notice that there's the

119
00:04:51,170 --> 00:04:47,759
largest discrepancy between the two

120
00:04:53,990 --> 00:04:51,180
partial dayside land cover so

121
00:04:55,670 --> 00:04:54,000
when it when it's not an aquaplanet or a

122
00:04:57,590 --> 00:04:55,680
land Planet somewhere in between it

123
00:04:59,749 --> 00:04:57,600
really matters a lot where the land is

124
00:05:01,550 --> 00:04:59,759
because that influences the amount of

125
00:05:03,050 --> 00:05:01,560
ice-free ocean that's available on the

126
00:05:04,909 --> 00:05:03,060
planet for evaporation and putting

127
00:05:07,129 --> 00:05:04,919
moisture into the atmosphere and these

128
00:05:08,330 --> 00:05:07,139
curves kind of follow each other

129
00:05:10,310 --> 00:05:08,340
so

130
00:05:13,129 --> 00:05:10,320
this is already a climate uncertainty

131
00:05:14,629 --> 00:05:13,139
that we need to kind of think about

132
00:05:16,550 --> 00:05:14,639
um

133
00:05:19,010 --> 00:05:16,560
now let's make it more complicated by

134
00:05:20,210 --> 00:05:19,020
changing another parameter the mass of

135
00:05:22,070 --> 00:05:20,220
the atmosphere so like land

136
00:05:23,510 --> 00:05:22,080
configuration that's not necessarily

137
00:05:24,469 --> 00:05:23,520
something we can know about a planet in

138
00:05:27,770 --> 00:05:24,479

advance

139
00:05:29,270 --> 00:05:27,780
so I varied it in my simulations the

140
00:05:31,070 --> 00:05:29,280
idea is

141
00:05:32,330 --> 00:05:31,080
basically make the atmosphere thicker or

142
00:05:33,290 --> 00:05:32,340
smaller that's what I've tried to show

143
00:05:35,029 --> 00:05:33,300
over here

144
00:05:37,909 --> 00:05:35,039
and

145
00:05:40,070 --> 00:05:37,919
these are the same curves that were on

146
00:05:44,330 --> 00:05:40,080
the previous slide but this time

147
00:05:46,930 --> 00:05:44,340
for a range of pressures so increasing

148
00:05:49,490 --> 00:05:46,940
the amount of N2 in the atmosphere

149
00:05:51,350 --> 00:05:49,500
and again you get

150
00:05:53,150 --> 00:05:51,360
the same land fraction and land

151
00:05:55,430 --> 00:05:53,160
configuration dependence

152
00:05:57,290 --> 00:05:55,440
but in addition to that the curves are

153
00:06:00,350 --> 00:05:57,300
shifted up or down depending on the

154
00:06:01,909 --> 00:06:00,360
pressure so they overlap it's very

155
00:06:03,590 --> 00:06:01,919
confusing

156
00:06:05,150 --> 00:06:03,600
um we

157
00:06:06,950 --> 00:06:05,160
like there's clearly some climate

158
00:06:10,249 --> 00:06:06,960
effects here that need to be paid

159
00:06:12,290 --> 00:06:10,259
attention to and so then the next thing

160
00:06:13,790 --> 00:06:12,300
we want to know is can we ever know this

161
00:06:15,469 --> 00:06:13,800
stuff can we tell these apart in

162
00:06:17,629 --> 00:06:15,479
observations

163
00:06:20,090 --> 00:06:17,639

so the way these planets will be

164
00:06:23,749 --> 00:06:20,100
observed is with Transit spectroscopy

165
00:06:26,150 --> 00:06:23,759
which is what jwst will do

166
00:06:27,650 --> 00:06:26,160
um I have a kind of image of what that

167
00:06:29,689 --> 00:06:27,660
looks like basically when the planet

168
00:06:31,730 --> 00:06:29,699
passes between the Observer and the star

169
00:06:34,490 --> 00:06:31,740
it blocks out some of the Stars light

170
00:06:36,230 --> 00:06:34,500
which is measurable and there's a

171
00:06:38,090 --> 00:06:36,240
wavelength dependent contribution to the

172
00:06:40,129 --> 00:06:38,100
amount of light blocked depending on the

173
00:06:41,870 --> 00:06:40,139
molecules in the atmosphere and where

174
00:06:44,809 --> 00:06:41,880
they scatter and absorb

175
00:06:46,550 --> 00:06:44,819
So based on what wavelengths block the

176
00:06:48,290 --> 00:06:46,560
most light we can tell what's in the

177
00:06:50,450 --> 00:06:48,300
atmosphere this is really hard to do for

178
00:06:51,890 --> 00:06:50,460
small planets but this is like the

179
00:06:53,090 --> 00:06:51,900
theory of it

180
00:06:54,770 --> 00:06:53,100
so

181
00:06:57,050 --> 00:06:54,780
the question then because most of the

182
00:06:58,670 --> 00:06:57,060
water if you'll recall was at the sub

183
00:07:01,189 --> 00:06:58,680
Stellar point is how much water is

184
00:07:02,809 --> 00:07:01,199
making it to the Terminator because the

185
00:07:04,550 --> 00:07:02,819
Terminator

186
00:07:07,070 --> 00:07:04,560
um sorry

187
00:07:08,450 --> 00:07:07,080
the the Terminator is where

188
00:07:09,770 --> 00:07:08,460

like we're getting actually the photons

189
00:07:11,090 --> 00:07:09,780
from we can't directly image the

190
00:07:15,710 --> 00:07:11,100
substellar point so we're getting the

191
00:07:20,749 --> 00:07:19,070
so I have some profiles here of specific

192
00:07:22,850 --> 00:07:20,759
humidity for the two different types of

193
00:07:24,050 --> 00:07:22,860
land map this is just all at the same

194
00:07:28,730 --> 00:07:24,060
pressure

195
00:07:31,610 --> 00:07:28,740
upward in the atmosphere on the y-axis

196
00:07:34,129 --> 00:07:31,620
and specific humidity on the x-axis

197
00:07:36,350 --> 00:07:34,139
for near the substellar point and near

198
00:07:38,510 --> 00:07:36,360
the Terminator so looking

199
00:07:41,089 --> 00:07:38,520
her relationship between

200
00:07:43,670 --> 00:07:41,099
the amount of water in the Rainy Zone

201
00:07:45,710 --> 00:07:43,680
and the amount of water we can see

202
00:07:47,089 --> 00:07:45,720
um subcellular Ocean Models

203
00:07:48,770 --> 00:07:47,099
all look pretty much the same which

204
00:07:50,809 --> 00:07:48,780
makes sense there's water there

205
00:07:52,969 --> 00:07:50,819
there's a bit less of the Terminator but

206
00:07:54,409 --> 00:07:52,979
it's still there for the substellar

207
00:07:57,050 --> 00:07:54,419
continent models the ones with a lot of

208
00:07:58,790 --> 00:07:57,060
land have much less water at the

209
00:08:01,370 --> 00:07:58,800
Terminator but still some

210
00:08:03,290 --> 00:08:01,380
so maybe we can tell the difference

211
00:08:05,990 --> 00:08:03,300
so now I've I'd like to show some

212
00:08:09,350 --> 00:08:06,000
synthetic Transit Spectra I've made

213
00:08:11,809 --> 00:08:09,360

using only water so I've ignored all

214
00:08:14,510 --> 00:08:11,819
other possible things that could

215
00:08:17,210 --> 00:08:14,520
contribute to this so on the x-axis we

216
00:08:19,850 --> 00:08:17,220
have wavelength that the instrument is

217
00:08:22,550 --> 00:08:19,860
observing at and on the y-axis we have

218
00:08:25,550 --> 00:08:22,560
what I've defined as amplitude so

219
00:08:27,890 --> 00:08:25,560
basically the difference between the

220
00:08:30,770 --> 00:08:27,900
transit depth that you get so the amount

221
00:08:33,110 --> 00:08:30,780
of light block from the star and the

222
00:08:35,810 --> 00:08:33,120
minimum amount so either the amount just

223
00:08:38,690 --> 00:08:35,820
by the rocky planet itself or the lowest

224
00:08:40,130 --> 00:08:38,700
cloud deck or the lowest part that that

225
00:08:41,930 --> 00:08:40,140
would be visible

226
00:08:43,969 --> 00:08:41,940
because it's really this difference that

227
00:08:46,190 --> 00:08:43,979
we're looking to measure more so than

228
00:08:48,410 --> 00:08:46,200
the actual size of the planet itself so

229
00:08:51,710 --> 00:08:48,420
these are just for a few selected

230
00:08:54,949 --> 00:08:51,720
simulations from my parameter space

231
00:08:57,050 --> 00:08:54,959
and so varying only the land and the

232
00:08:59,570 --> 00:08:57,060
pressure we get quite a sizable

233
00:09:00,470 --> 00:08:59,580
difference in these water vapor spectral

234
00:09:01,790 --> 00:09:00,480
features

235
00:09:03,889 --> 00:09:01,800
so these could

236
00:09:06,889 --> 00:09:03,899
these are kind of a range of what a

237
00:09:08,750 --> 00:09:06,899
specific Planet might produce

238
00:09:10,910 --> 00:09:08,760

um then on the bottom we have the Cloudy

239
00:09:12,410 --> 00:09:10,920
version so these same ones but with

240
00:09:14,810 --> 00:09:12,420
clouds included in the radiative

241
00:09:16,670 --> 00:09:14,820
transfer and

242
00:09:18,769 --> 00:09:16,680
you'll notice that the features are

243
00:09:21,610 --> 00:09:18,779
smaller but also they're not all

244
00:09:24,410 --> 00:09:21,620
affected the same way depending on

245
00:09:27,170 --> 00:09:24,420
where like how many how many clouds are

246
00:09:29,750 --> 00:09:27,180
at the Terminator which varies depending

247
00:09:31,550 --> 00:09:29,760
on different factors so it's a bit

248
00:09:34,190 --> 00:09:31,560
confusing

249
00:09:39,110 --> 00:09:36,530
I'd like to just focus on on this

250
00:09:41,810 --> 00:09:39,120
feature though so

251
00:09:47,150 --> 00:09:41,820
I'd like to show like basically the top

252
00:09:49,190 --> 00:09:47,160
of this feature for a variety of models

253
00:09:51,110 --> 00:09:49,200
and that's what this looks like on the

254
00:09:54,290 --> 00:09:51,120
left we have the cloud free version on

255
00:09:55,250 --> 00:09:54,300
the right we have with clouds included

256
00:09:57,230 --> 00:09:55,260
um

257
00:09:58,970 --> 00:09:57,240
again these curves kind of follow the

258
00:10:01,009 --> 00:09:58,980
same shape as the temperature and water

259
00:10:02,509 --> 00:10:01,019
vapor from a few slides ago

260
00:10:06,250 --> 00:10:02,519
but

261
00:10:09,829 --> 00:10:06,260
when you add clouds it gets a lot worse

262
00:10:11,449 --> 00:10:09,839
unfortunately basically

263
00:10:13,790 --> 00:10:11,459

there's there's like some correlations

264
00:10:16,910 --> 00:10:13,800
in a cloud-free version these high

265
00:10:18,769 --> 00:10:16,920
pressure low land models have much

266
00:10:20,990 --> 00:10:18,779
taller spectral features so you might be

267
00:10:22,370 --> 00:10:21,000
able to detect that or tell the

268
00:10:24,769 --> 00:10:22,380
difference but then when we add clouds

269
00:10:26,630 --> 00:10:24,779
what happens is that these Waters these

270
00:10:29,870 --> 00:10:26,640
models with the most water vapor are

271
00:10:31,670 --> 00:10:29,880
also the cloudiest of the Terminator and

272
00:10:34,610 --> 00:10:31,680
consequently

273
00:10:37,730 --> 00:10:34,620
theme like the effect of clouds on a

274
00:10:40,070 --> 00:10:37,740
spectrum is much higher so

275
00:10:42,230 --> 00:10:40,080
like that it gets like artificially

276
00:10:45,170 --> 00:10:42,240
subdued so it looks like these dry

277
00:10:47,030 --> 00:10:45,180
models over here have the most water but

278
00:10:48,710 --> 00:10:47,040
that's not actually true

279
00:10:49,970 --> 00:10:48,720
so observing this

280
00:10:51,470 --> 00:10:49,980
it's going to be very hard to tell

281
00:10:52,910 --> 00:10:51,480
what's going on on the surface of the

282
00:10:54,769 --> 00:10:52,920
planet

283
00:10:56,690 --> 00:10:54,779
um

284
00:10:59,329 --> 00:10:56,700
just

285
00:11:01,130 --> 00:10:59,339
try to end on a happy note

286
00:11:03,769 --> 00:11:01,140
um there's a huge range of climates here

287
00:11:05,630 --> 00:11:03,779
we can't necessarily tell them apart but

288
00:11:07,790 --> 00:11:05,640

a lot of them could be habitable and we

289
00:11:08,810 --> 00:11:07,800
might be able to detect water in some of

290
00:11:10,610 --> 00:11:08,820
them

291
00:11:12,350 --> 00:11:10,620
so

292
00:11:15,170 --> 00:11:12,360
like I'm still like cautiously

293
00:11:17,930 --> 00:11:15,180
optimistic I guess but

294
00:11:19,310 --> 00:11:17,940
it's it's more important I think to

295
00:11:22,069 --> 00:11:19,320
account for the fact that there are

296
00:11:23,389 --> 00:11:22,079
these unknowns instead of just trying to

297
00:11:25,670 --> 00:11:23,399
make assumptions about what's going on

298
00:11:27,650 --> 00:11:25,680
on the surface of the planet based on

299
00:11:29,630 --> 00:11:27,660
its Transit Spectrum

300
00:11:30,920 --> 00:11:29,640
I'll stop here and I'm happy to take any

301
00:11:37,520 --> 00:11:30,930
questions

302
00:11:37,530 --> 00:11:46,430
[Applause]

303
00:11:50,569 --> 00:11:48,470
hi uh great talk

304
00:11:52,610 --> 00:11:50,579
um really interesting stuff so I'm

305
00:11:55,910 --> 00:11:52,620
wondering about you have these simulated

306
00:11:59,329 --> 00:11:55,920
spec Transit Spectra I'm

307
00:12:02,210 --> 00:11:59,339
and it looks a little uh pessimistic

308
00:12:04,250 --> 00:12:02,220
based on how close those lines are but

309
00:12:07,550 --> 00:12:04,260
jwst has been delivering some

310
00:12:10,670 --> 00:12:07,560
exquisitely Precision precise Spectra so

311
00:12:12,829 --> 00:12:10,680
I'm wondering if you have plans to model

312
00:12:14,690 --> 00:12:12,839
like the noise properties and stuff and

313
00:12:16,490 --> 00:12:14,700

it like actually simulate jwst

314
00:12:17,810 --> 00:12:16,500
observations of these kind of things to

315
00:12:20,090 --> 00:12:17,820
see if you can actually distinguish

316
00:12:22,430 --> 00:12:20,100
maybe a few things because the trans

317
00:12:24,110 --> 00:12:22,440
inspector are so precise

318
00:12:25,310 --> 00:12:24,120
um because of this incredible instrument

319
00:12:26,930 --> 00:12:25,320
that we have

320
00:12:28,730 --> 00:12:26,940
yeah it would be good to add some

321
00:12:31,310 --> 00:12:28,740
instrumental noise to them it's also

322
00:12:32,810 --> 00:12:31,320
really hard to do that accurately

323
00:12:34,970 --> 00:12:32,820
um there's like

324
00:12:36,949 --> 00:12:34,980
it's it's harder to get precise Spectra

325
00:12:39,110 --> 00:12:36,959
for these smaller stars like most of

326
00:12:41,150 --> 00:12:39,120
what's been coming so far is or sorry

327
00:12:44,389 --> 00:12:41,160
smaller planets bigger bigger planets

328
00:12:46,129 --> 00:12:44,399
are easier to get like good data from

329
00:12:48,470 --> 00:12:46,139
but yeah there's

330
00:12:50,329 --> 00:12:48,480
um there's more Photon noise in the far

331
00:12:51,949 --> 00:12:50,339
or mid infrared compared to the near

332
00:12:53,509 --> 00:12:51,959
infrared so I think it'd be good to

333
00:12:56,030 --> 00:12:53,519
focus on that but

334
00:12:57,769 --> 00:12:56,040
yeah it would be

335
00:12:59,569 --> 00:12:57,779
like it might be possible to tell some

336
00:13:00,710 --> 00:12:59,579
of them apart but it would be a good

337
00:13:05,810 --> 00:13:00,720
thing to look into thanks for the

338
00:13:10,610 --> 00:13:09,050

Taylor plattner at Georgia Tech great

339
00:13:12,170 --> 00:13:10,620
talk also just wanted to say all the

340
00:13:13,310 --> 00:13:12,180
other talks were very interesting this

341
00:13:15,230 --> 00:13:13,320
morning

342
00:13:17,030 --> 00:13:15,240
um and it's super cool I used to do

343
00:13:19,310 --> 00:13:17,040
exoplanet stuff when I was in undergrad

344
00:13:21,290 --> 00:13:19,320
so you're taking me back to I guess my

345
00:13:25,129 --> 00:13:21,300
old days sounds like I'm an old person

346
00:13:27,050 --> 00:13:25,139
um but uh I had a question on you know I

347
00:13:29,329 --> 00:13:27,060
know you're doing simulations but are

348
00:13:34,430 --> 00:13:29,339
you going to eventually like

349
00:13:36,230 --> 00:13:34,440
look at specific planets and if so do

350
00:13:38,690 --> 00:13:36,240
you have like a I don't know there's

351
00:13:40,610 --> 00:13:38,700
kind of like I used to do this like a

352
00:13:42,350 --> 00:13:40,620
development like a prototype um

353
00:13:44,090 --> 00:13:42,360
instrument to put on ground-based

354
00:13:46,850 --> 00:13:44,100
telescope to like vet out interesting

355
00:13:49,370 --> 00:13:46,860
planets so I didn't know if you had like

356
00:13:51,050 --> 00:13:49,380
a I don't know anything to like vet out

357
00:13:54,590 --> 00:13:51,060
interesting planets to you like with

358
00:13:55,970 --> 00:13:54,600
jwst or with any other like telescope

359
00:13:58,610 --> 00:13:55,980
um sorry if that's a terrible question

360
00:14:01,670 --> 00:13:58,620
but just curious no it's an interesting

361
00:14:03,470 --> 00:14:01,680
I'm not an observer I'm mostly just

362
00:14:06,710 --> 00:14:03,480
waiting excitedly for other people to

363
00:14:08,030 --> 00:14:06,720

get data and like I would say the one

364
00:14:11,210 --> 00:14:08,040
I'm most excited about is probably

365
00:14:13,009 --> 00:14:11,220
Travis 20 but excited and apprehensive

366
00:14:14,629 --> 00:14:13,019
at the same time because it'll be really

367
00:14:17,509 --> 00:14:14,639
sad if they don't find an atmosphere on

368
00:14:19,790 --> 00:14:17,519
it but yeah ground ground-based

369
00:14:21,829 --> 00:14:19,800
observations would be like another

370
00:14:23,030 --> 00:14:21,839
good way to to look at these planets

371
00:14:27,110 --> 00:14:23,040
because you can get such a bigger

372
00:14:29,449 --> 00:14:27,120
telescope okay this is with jwst how

373
00:14:30,829 --> 00:14:29,459
often is it like looking at like if you

374
00:14:33,290 --> 00:14:30,839
had some planner that you're really

375
00:14:35,569 --> 00:14:33,300
interested in how often is it like

376
00:14:37,370 --> 00:14:35,579
looking at that planet or would you like

377
00:14:38,990 --> 00:14:37,380
I don't know I know Tess was another one

378
00:14:41,030 --> 00:14:39,000
that people like were really excited

379
00:14:45,769 --> 00:14:41,040
about so I didn't know if that was

380
00:14:48,290 --> 00:14:45,779
easier to like get data like to see that

381
00:14:49,910 --> 00:14:48,300
same Planet more and I know it yeah like

382
00:14:53,689 --> 00:14:49,920
you were saying it's not as great

383
00:14:56,870 --> 00:14:53,699
everybody loves JW wst for a reason yeah

384
00:14:59,629 --> 00:14:56,880
well Tess is a planet finder so it it's

385
00:15:02,449 --> 00:14:59,639
found a bunch of candidates

386
00:15:04,370 --> 00:15:02,459
so like anything that starts with toi I

387
00:15:05,870 --> 00:15:04,380
mean tests object of Interest what

388
00:15:08,210 --> 00:15:05,880

they're called

389
00:15:10,370 --> 00:15:08,220
um and then jwst is kind of needed or

390
00:15:11,750 --> 00:15:10,380
like some large telescope is needed for

391
00:15:13,430 --> 00:15:11,760
follow-up to actually characterize their

392
00:15:15,829 --> 00:15:13,440
atmospheres because it's much easier to

393
00:15:17,750 --> 00:15:15,839
find the planets than to see what's in

394
00:15:19,069 --> 00:15:17,760
their atmospheres especially with such

395
00:15:21,050 --> 00:15:19,079
thin ones

396
00:15:22,970 --> 00:15:21,060
uh did that answer the question

397
00:15:25,970 --> 00:15:22,980
yeah yeah

398
00:15:31,430 --> 00:15:25,980
good talk thank you thank you so much

399
00:15:35,870 --> 00:15:34,370
hi that was also super I'm pretty far

400
00:15:38,389 --> 00:15:35,880
removed from this exoplanet stuff

401
00:15:39,949 --> 00:15:38,399
because this is sick so um I I have a

402
00:15:41,389 --> 00:15:39,959
question that I apologize for my

403
00:15:43,069 --> 00:15:41,399
inability to ask a more specific

404
00:15:46,189 --> 00:15:43,079
question about your work that's just a

405
00:15:48,650 --> 00:15:46,199
lack of my understanding but um I'm

406
00:15:51,590 --> 00:15:48,660
curious that they were talking about how

407
00:15:54,710 --> 00:15:51,600
like this Exquisite Precision with jwst

408
00:15:57,590 --> 00:15:54,720
and and all this stuff and so is how far

409
00:16:00,110 --> 00:15:57,600
off well I'll preface by saying

410
00:16:01,730 --> 00:16:00,120
um the past couple of decades as I'm

411
00:16:03,170 --> 00:16:01,740
sure you're aware our understanding of

412
00:16:05,930 --> 00:16:03,180
planetary habitability has really

413
00:16:07,430 --> 00:16:05,940

shifted with the uh our increased

414
00:16:09,410 --> 00:16:07,440
understanding of these icy moons in our

415
00:16:15,250 --> 00:16:09,420
solar system and things like that

416
00:16:18,290 --> 00:16:15,260
um how far off is our ability to examine

417
00:16:20,629 --> 00:16:18,300
moons of exoplanets given like a small

418
00:16:22,610 --> 00:16:20,639
enough star or something like that or is

419
00:16:24,590 --> 00:16:22,620
that just like so far off from reality

420
00:16:27,170 --> 00:16:24,600
given their technological abilities at

421
00:16:30,230 --> 00:16:27,180
the moment I would say it's that's far

422
00:16:31,550 --> 00:16:30,240
off unforged like yeah the problem is

423
00:16:32,870 --> 00:16:31,560
that that you have to like detect the

424
00:16:35,569 --> 00:16:32,880
planet and then the moon going around

425
00:16:37,490 --> 00:16:35,579
the planet and it's they're just really

426
00:16:38,629 --> 00:16:37,500
hard to find and they'll be even harder

427
00:16:40,430 --> 00:16:38,639
to observe

428
00:16:42,769 --> 00:16:40,440
which is unfortunate because I bet EXO

429
00:16:44,509 --> 00:16:42,779
moons are really cool

430
00:16:45,829 --> 00:16:44,519
and that would also deal with the tidal

431
00:16:50,210 --> 00:16:45,839
locking problem

432
00:16:52,790 --> 00:16:50,220
like like if an exumun was orbiting

433
00:16:55,069 --> 00:16:52,800
it's tidally locked Planet the moon will

434
00:16:56,389 --> 00:16:55,079
not be totally locked to the star so it

435
00:16:58,850 --> 00:16:56,399
could have day night cycles but they're

436
00:17:00,710 --> 00:16:58,860
just really hard to observe

437
00:17:02,509 --> 00:17:00,720
yeah thanks for that that would be

438
00:17:04,069 --> 00:17:02,519

really cool

439
00:17:09,589 --> 00:17:04,079
thank you for the talk everyone well

440
00:17:12,270 --> 00:17:10,010
[Music]