



AN EXOCLIMES SCALE FOR THE  
REMOTE DETECTION OF LIFE  
ABOVE THE ATMOSPHERE  
*JOSEPH HARRINGTON*

1  
00:00:09,670 --> 00:00:03,700

[Music]

2  
00:00:11,530 --> 00:00:09,680

I get really annoyed when people use up

3  
00:00:13,780 --> 00:00:11,540

my question time to promote their thing

4  
00:00:17,890 --> 00:00:13,790

so I'm gonna use my talk time to promote

5  
00:00:21,040 --> 00:00:17,900

my thing so quick quick announcement the

6  
00:00:25,240 --> 00:00:21,050

NASA money for us early career people

7  
00:00:26,920 --> 00:00:25,250

came in last night at 10:00 p.m. so so

8  
00:00:29,380 --> 00:00:26,930

so they actually delivered them the

9  
00:00:31,810 --> 00:00:29,390

money before the meeting ended if if

10  
00:00:35,069 --> 00:00:31,820

this describes you if you're in NASA if

11  
00:00:40,840 --> 00:00:35,079

you're a US graduate student or postdoc

12  
00:00:43,150 --> 00:00:40,850

and that does include NYU ad there's

13  
00:00:46,930 --> 00:00:43,160

some funding available to support travel

14

00:00:48,370 --> 00:00:46,940

here we're gonna cover the raised fee

15

00:00:50,049 --> 00:00:48,380

waivers first because he did that out of

16

00:00:56,310 --> 00:00:50,059

his personal research funds which great

17

00:01:01,030 --> 00:00:59,200

the important thing is don't send your

18

00:01:02,560 --> 00:01:01,040

receipts in to your university for

19

00:01:05,410 --> 00:01:02,570

reimbursement because you can't get

20

00:01:07,690 --> 00:01:05,420

reimbursed for the same thing twice and

21

00:01:12,160 --> 00:01:07,700

I will follow up in an e-mail early next

22

00:01:13,510 --> 00:01:12,170

week okay and then also there was a

23

00:01:15,609 --> 00:01:13,520

bunch of stuff this morning about

24

00:01:17,890 --> 00:01:15,619

needing more measurements in the lab of

25

00:01:20,469 --> 00:01:17,900

various things we just hired two new

26  
00:01:21,940 --> 00:01:20,479  
faculty cari Donaldson Hannah was just

27  
00:01:24,310 --> 00:01:21,950  
hired this year Chris Bennett was hired

28  
00:01:26,620 --> 00:01:24,320  
a couple of years ago and they do

29  
00:01:29,170 --> 00:01:26,630  
astrochemistry spectroscopy surface

30  
00:01:31,000 --> 00:01:29,180  
processes in the lab they'll also do

31  
00:01:32,859 --> 00:01:31,010  
some things that are not straight up on

32  
00:01:34,539 --> 00:01:32,869  
the surface so if you want to produce

33  
00:01:38,219 --> 00:01:34,549  
the measured talk to them and our

34  
00:01:40,300 --> 00:01:38,229  
website is planets that UCF that edu and

35  
00:01:40,810 --> 00:01:40,310  
finally if you didn't sign up for dinner

36  
00:01:45,130 --> 00:01:40,820  
either

37  
00:01:47,530 --> 00:01:45,140  
you talk to me okay all right so so I

38  
00:01:50,080 --> 00:01:47,540

put up this slide in like when I when I

39

00:01:52,300 --> 00:01:50,090

brought this topic up on Monday so the

40

00:01:54,670 --> 00:01:52,310

the SETI community has this scale that

41

00:01:57,760 --> 00:01:54,680

they developed in Rio in 2005 updated in

42

00:01:59,740 --> 00:01:57,770

2018 and they they call it an excitement

43

00:02:02,530 --> 00:01:59,750

level which is maybe not an appropriate

44

00:02:05,410 --> 00:02:02,540

thing for their topic and they're there

45

00:02:07,569 --> 00:02:05,420

they their formulas are equals two times

46

00:02:10,869 --> 00:02:07,579

Delta and Q is the consequence of the

47

00:02:13,479 --> 00:02:10,879

signal and Delta is the credibility of

48

00:02:15,970 --> 00:02:13,489

the signal and we kind of in our

49

00:02:19,119 --> 00:02:15,980

discussions this week we kind of have

50

00:02:21,220 --> 00:02:19,129

started that much of their scale we

51  
00:02:23,799 --> 00:02:21,230  
pretty much throughout the rest of it

52  
00:02:28,360 --> 00:02:23,809  
but but maybe that's well if we can

53  
00:02:29,559 --> 00:02:28,370  
we'll continue to talk about that so the

54  
00:02:31,000 --> 00:02:29,569  
other thing and we didn't talk about

55  
00:02:32,949 --> 00:02:31,010  
this in our breakout meeting the other

56  
00:02:34,599 --> 00:02:32,959  
day but we did I'd have talked about it

57  
00:02:38,080 --> 00:02:34,609  
a lot with individuals people seem to

58  
00:02:40,869 --> 00:02:38,090  
like this kind of language for the

59  
00:02:43,030 --> 00:02:40,879  
description of new observations so if

60  
00:02:45,159 --> 00:02:43,040  
you've got you know if you if you see

61  
00:02:46,629 --> 00:02:45,169  
something and you you've you're you know

62  
00:02:50,530 --> 00:02:46,639  
you're you're announcing a discovery you

63  
00:02:52,599 --> 00:02:50,540

call it a speculative signal and once it

64

00:02:54,189 --> 00:02:52,609

goes through the process of having you

65

00:02:55,509 --> 00:02:54,199

know increased verification and

66

00:02:58,299 --> 00:02:55,519

demonstrating that it's not instrumental

67

00:03:00,789 --> 00:02:58,309

and so forth you can start calling it

68

00:03:02,140 --> 00:03:00,799

things like you know a verified signal a

69

00:03:05,679 --> 00:03:02,150

candidate's signal in an actual

70

00:03:08,110 --> 00:03:05,689

discovery those conservative words

71

00:03:09,610 --> 00:03:08,120

prevent us from overhyping and really

72

00:03:11,679 --> 00:03:09,620

what it does is it prevents the media

73

00:03:13,599 --> 00:03:11,689

from EE overhyping you're not very

74

00:03:14,890 --> 00:03:13,609

overhyped it's press release which

75

00:03:18,099 --> 00:03:14,900

they'd like to do or at least some of

76

00:03:20,589 --> 00:03:18,109

them like to do a process keeps the

77

00:03:22,360 --> 00:03:20,599

public engaged in what we do longer so

78

00:03:24,159 --> 00:03:22,370

if they if you say you know I've got a

79

00:03:25,780 --> 00:03:24,169

speculative signal on the next step is

80

00:03:30,489 --> 00:03:25,790

for somebody else to go look at it and

81

00:03:32,199 --> 00:03:30,499

and and verify it then people know that

82

00:03:34,659 --> 00:03:32,209

there's maybe they're maybe gonna hear

83

00:03:36,250 --> 00:03:34,669

more about this and then finally that

84

00:03:37,959 --> 00:03:36,260

discovery is something that the field

85

00:03:43,959 --> 00:03:37,969

does when science works and we have

86

00:03:45,399 --> 00:03:43,969

consensus about a result okay so these

87

00:03:47,649 --> 00:03:45,409

are the questions I put up should we

88

00:03:49,569 --> 00:03:47,659

adopt these terms was the first question

89

00:03:52,000 --> 00:03:49,579

I'm curious how people feel about that

90

00:03:53,589 --> 00:03:52,010

so let's do a show of hands if you like

91

00:03:54,579 --> 00:03:53,599

that idea meaning like it well enough

92

00:03:56,109 --> 00:03:54,589

that you're gonna do it in your own

93

00:03:59,349 --> 00:03:56,119

press release call your own press

94

00:04:00,879 --> 00:03:59,359

release speculate on the first go let me

95

00:04:03,729 --> 00:04:00,889

see what that how many people feel good

96

00:04:07,569 --> 00:04:03,739

with that many people don't feel so good

97

00:04:10,329 --> 00:04:07,579

with that okay how many people aren't

98

00:04:12,989 --> 00:04:10,339

sure all right now how many people

99

00:04:17,199 --> 00:04:12,999

didn't raise their hand no anyway okay

100

00:04:21,429 --> 00:04:17,209

so I see not consensus but but certainly

101

00:04:23,439 --> 00:04:21,439

a lot of interest in in terms like that

102

00:04:25,749 --> 00:04:23,449

so maybe we can may find some terms that

103

00:04:28,839 --> 00:04:25,759

aren't quite so derogatory but maybe

104

00:04:32,919 --> 00:04:28,849

also don't call something so

105

00:04:35,320 --> 00:04:32,929

on the first go all right as far as I

106

00:04:37,959 --> 00:04:35,330

know at this point there is not yet a

107

00:04:40,839 --> 00:04:37,969

scale for this in the works there was

108

00:04:43,419 --> 00:04:40,849

mention of a paper by Dave Catlin which

109

00:04:45,969 --> 00:04:43,429

is a nice description of how to do

110

00:04:47,499 --> 00:04:45,979

Bayesian analysis on bio signatures so

111

00:04:48,999 --> 00:04:47,509

that's part of what we're interested in

112

00:04:52,179 --> 00:04:49,009

but it doesn't talk about things like

113

00:04:54,129 --> 00:04:52,189

meeting multiple observations or you

114

00:04:58,029 --> 00:04:54,139

know whether the signal might be

115

00:05:02,109 --> 00:04:58,039

confused for something else we I guess

116

00:05:04,570 --> 00:05:02,119

we're making a scale in our discussion

117

00:05:06,159 --> 00:05:04,580

we kind of decided the real to the

118

00:05:08,169 --> 00:05:06,169

details of Rio to were a little bit too

119

00:05:09,639 --> 00:05:08,179

complicated for us and I think that

120

00:05:12,459 --> 00:05:09,649

might be possible for them because

121

00:05:14,409 --> 00:05:12,469

they've thought a lot about specifically

122

00:05:16,480 --> 00:05:14,419

the kinds of signals they expect to see

123

00:05:18,070 --> 00:05:16,490

and it's a pretty much narrower range of

124

00:05:20,589 --> 00:05:18,080

I think it's a narrow range of ideas

125

00:05:24,639 --> 00:05:20,599

than then the kinds of things that we

126

00:05:28,989 --> 00:05:24,649

are talking about for for non

127

00:05:31,719 --> 00:05:28,999

intelligent life so we didn't we didn't

128

00:05:34,449 --> 00:05:31,729

like the complexity we stuck to

129

00:05:37,689 --> 00:05:34,459

something a little bit more conceptually

130

00:05:40,600 --> 00:05:37,699

simple so we developed a draft scale

131

00:05:42,069 --> 00:05:40,610

which I'll show you shortly and bring it

132

00:05:43,540 --> 00:05:42,079

back here for discussion I don't know if

133

00:05:45,459 --> 00:05:43,550

we're ready to vote on something but at

134

00:05:46,899 --> 00:05:45,469

least we'll ask if you know people think

135

00:05:49,359 --> 00:05:46,909

it's a reasonable idea to proceed with

136

00:05:51,309 --> 00:05:49,369

the next step is to develop a paper and

137

00:05:52,839 --> 00:05:51,319

a website and the website is important

138

00:05:55,029 --> 00:05:52,849

because the papers gonna talk to our

139

00:05:58,119 --> 00:05:55,039

colleagues the websites gonna talk to

140

00:05:59,619 --> 00:05:58,129

the press and people who are reading

141

00:06:02,469 --> 00:05:59,629

stuff and wondering what this scale is

142

00:06:04,209 --> 00:06:02,479

and so forth so that website is probably

143

00:06:05,709 --> 00:06:04,219

as important for the success of this

144

00:06:07,179 --> 00:06:05,719

thing as a paper if we just publish a

145

00:06:10,329 --> 00:06:07,189

paper it will it will dive into some

146

00:06:12,129 --> 00:06:10,339

journal and never come out if you're

147

00:06:14,109 --> 00:06:12,139

interested in in joining us and you

148

00:06:17,259 --> 00:06:14,119

haven't yet please send me an email

149

00:06:18,609 --> 00:06:17,269

I'm JH at physics that UCF I didi you

150

00:06:21,699 --> 00:06:18,619

and of course I put that last which

151

00:06:24,339 --> 00:06:21,709

means I better wait 11 seconds for

152

00:06:28,029 --> 00:06:24,349

people to note it maybe I don't have to

153

00:06:29,799 --> 00:06:28,039

way to fall 11 seconds okay alright so

154

00:06:32,230 --> 00:06:29,809

this is what we kind of came up with as

155

00:06:33,790 --> 00:06:32,240

a ballpark thing and that the key item

156

00:06:36,669 --> 00:06:33,800

for us was a great idea by Peter

157

00:06:39,339 --> 00:06:36,679

Wheatley which is that if you don't have

158

00:06:41,239 --> 00:06:39,349

someone's periodically people will

159

00:06:42,979 --> 00:06:41,249

forget that you exist

160

00:06:44,749 --> 00:06:42,989

I think that's the problem with Rio it

161

00:06:45,979 --> 00:06:44,759

was so hard it's so hard to get a one in

162

00:06:48,889 --> 00:06:45,989

Rio that I don't know that it's ever

163

00:06:51,589 --> 00:06:48,899

happened and so as a consequence Rio in

164

00:06:52,999 --> 00:06:51,599

2005 there were you know maybe some

165

00:06:55,069 --> 00:06:53,009

discussions at some point and people

166

00:06:57,019 --> 00:06:55,079

talked about it and then the people can

167

00:06:58,249 --> 00:06:57,029

attend it to stop using it so on the

168

00:06:59,899 --> 00:06:58,259

other hand the Torino scale for

169

00:07:01,429 --> 00:06:59,909

asteroids they've got four or five

170

00:07:02,989 --> 00:07:01,439

asteroids a year there were a one in

171

00:07:05,329 --> 00:07:02,999

there scale so people keep using and

172

00:07:07,399 --> 00:07:05,339

hearing about their scale so we decided

173

00:07:09,259 --> 00:07:07,409

a one would be a place that life could

174

00:07:10,639 --> 00:07:09,269

exist like it like you don't

175

00:07:12,319 --> 00:07:10,649

automatically rule it out like a

176

00:07:13,339 --> 00:07:12,329

terrestrial planet and have habitable

177

00:07:15,350 --> 00:07:13,349

zone and I know we have to go argue

178

00:07:16,669 --> 00:07:15,360

about what the habitable zone is but but

179

00:07:19,009 --> 00:07:16,679

that's all sort of part of the process

180

00:07:21,169 --> 00:07:19,019

and a2 is maybe a place where life

181

00:07:22,909 --> 00:07:21,179

should exist like an ocean so maybe

182

00:07:24,109 --> 00:07:22,919

you've got a specular reflection or

183

00:07:25,789 --> 00:07:24,119

something like that you have evidence

184

00:07:28,549 --> 00:07:25,799

for an ocean that would be pushing it

185

00:07:30,709 --> 00:07:28,559

toward a two three or four would be an

186

00:07:32,239 --> 00:07:30,719

individual bio signature and you would

187

00:07:34,249 --> 00:07:32,249

go three or four depending on how

188

00:07:35,089 --> 00:07:34,259

convincing that kind of bio signature

189

00:07:37,189 --> 00:07:35,099

was in the community

190

00:07:39,409 --> 00:07:37,199

five to seven would be multiple

191

00:07:41,509 --> 00:07:39,419

independent bio signatures and this

192

00:07:42,799 --> 00:07:41,519

really damn good buy a signature would

193

00:07:45,499 --> 00:07:42,809

be eight to ten that would be something

194

00:07:47,989 --> 00:07:45,509

like a high-resolution spectrum of a

195

00:07:49,819 --> 00:07:47,999

molecule that can only be produced by

196

00:07:52,879 --> 00:07:49,829

life and I don't mean like phosphine I

197

00:07:55,509 --> 00:07:52,889

mean like chlorophyll and then we had a

198

00:08:00,289 --> 00:07:55,519

question right what if you found CFCs

199

00:08:02,259 --> 00:08:00,299

okay so if you if you can convince us

200

00:08:06,289 --> 00:08:02,269

that CFCs cannot be produced naturally

201  
00:08:07,939 --> 00:08:06,299  
then CFCs might be something in here but

202  
00:08:11,719 --> 00:08:07,949  
they would certainly be something in

203  
00:08:13,399 --> 00:08:11,729  
there and so and it's with CFCs maybe

204  
00:08:14,509 --> 00:08:13,409  
it's something in here and then you call

205  
00:08:16,069 --> 00:08:14,519  
up your Shetty friends since they go

206  
00:08:17,269 --> 00:08:16,079  
look at that planet and then maybe

207  
00:08:21,919 --> 00:08:17,279  
they'll come back with some additional

208  
00:08:24,350 --> 00:08:21,929  
line of lines of evidence okay we did

209  
00:08:25,489 --> 00:08:24,360  
not talk quantitatively about signal

210  
00:08:27,859 --> 00:08:25,499  
quality we've pretty much spent all of

211  
00:08:30,739 --> 00:08:27,869  
our time on the state on the the the

212  
00:08:33,049 --> 00:08:30,749  
signal interpretation scale but we did

213  
00:08:34,819 --> 00:08:33,059

have some general agreement on some

214

00:08:36,439 --> 00:08:34,829

items that we want to see in a highly

215

00:08:38,509 --> 00:08:36,449

rated signal like multiple observations

216

00:08:41,389 --> 00:08:38,519

multiple analyses by different teams

217

00:08:43,369 --> 00:08:41,399

multiple instruments reliable or

218

00:08:46,009 --> 00:08:43,379

respectable methods or instruments so if

219

00:08:50,119 --> 00:08:46,019

you're talking about you know a 10 ppm

220

00:08:52,280 --> 00:08:50,129

result with Spitzer no but you know

221

00:08:53,720 --> 00:08:52,290

perhaps with other telescopes standing

222

00:08:54,940 --> 00:08:53,730

the test of time so there's time for

223

00:08:56,800 --> 00:08:54,950

people to come up with

224

00:08:58,450 --> 00:08:56,810

alternative ways of interpreting the

225

00:09:01,000 --> 00:08:58,460

data alternative ways of analyzing the

226

00:09:03,670 --> 00:09:01,010

data and so perhaps we'll end up with a

227

00:09:06,790 --> 00:09:03,680

0 to 1 scale that multiplies the other

228

00:09:08,590 --> 00:09:06,800

scale because everybody likes 1 to 10 so

229

00:09:10,240 --> 00:09:08,600

this is the Torino scale and you'll

230

00:09:13,330 --> 00:09:10,250

notice that it's got these sort of

231

00:09:15,460 --> 00:09:13,340

diagonal zones so as you as your your

232

00:09:18,060 --> 00:09:15,470

level of concern increases the level of

233

00:09:20,770 --> 00:09:18,070

probability that you care about drops

234

00:09:23,110 --> 00:09:20,780

here's the what I'm sort of a quick

235

00:09:27,100 --> 00:09:23,120

graphic I made out of out of ours and so

236

00:09:30,130 --> 00:09:27,110

your your 9 and 10 are up here that's 0

237

00:09:33,100 --> 00:09:30,140

here's 1 and 2 so if you're if this is

238

00:09:35,050 --> 00:09:33,110

the the scale I gave you before for the

239

00:09:36,850 --> 00:09:35,060

significance of the evidence and this is

240

00:09:38,590 --> 00:09:36,860

the quality of the evidence this is that

241

00:09:40,600 --> 00:09:38,600

that last slide where you maybe go from

242

00:09:42,730 --> 00:09:40,610

0 to 1 so if you've got a really firm

243

00:09:46,690 --> 00:09:42,740

detection of a terrestrial planet your

244

00:09:49,810 --> 00:09:46,700

zero 1 and then if you've got a really

245

00:09:51,310 --> 00:09:49,820

firm detection of a single bio signature

246

00:09:52,990 --> 00:09:51,320

it's going to be in this range you've

247

00:09:54,880 --> 00:09:53,000

got kind of a weak detection of a single

248

00:09:57,550 --> 00:09:54,890

biosignature you're probably still at 2

249

00:09:59,350 --> 00:09:57,560

and and you know maybe the curvature

250

00:10:00,580 --> 00:09:59,360

exact placement disease curves get

251  
00:10:05,560 --> 00:10:00,590  
shipped around but that's the general

252  
00:10:07,630 --> 00:10:05,570  
idea so next steps quantify that signal

253  
00:10:10,720 --> 00:10:07,640  
quality scale and and how we combine the

254  
00:10:12,940 --> 00:10:10,730  
two we obviously we need to involve some

255  
00:10:14,970 --> 00:10:12,950  
more bio signature experts than we

256  
00:10:18,850 --> 00:10:14,980  
currently have which is approximately 1

257  
00:10:20,950 --> 00:10:18,860  
i it's been suggested that we include a

258  
00:10:22,930 --> 00:10:20,960  
philosopher some press officers and some

259  
00:10:27,520 --> 00:10:22,940  
press people just to see that this could

260  
00:10:29,170 --> 00:10:27,530  
actually be be used evaluating examples

261  
00:10:30,940 --> 00:10:29,180  
independently coming up with idea with

262  
00:10:32,680 --> 00:10:30,950  
with you know if I had a such and such

263  
00:10:34,510 --> 00:10:32,690

quality observation of this particular

264

00:10:35,890 --> 00:10:34,520

bias hit room how would you rate it and

265

00:10:37,660 --> 00:10:35,900

give that to a bunch of people and see

266

00:10:39,670 --> 00:10:37,670

that you can actually use this rating

267

00:10:40,990 --> 00:10:39,680

system consistently would certainly be

268

00:10:44,160 --> 00:10:41,000

something we have to do they did it for

269

00:10:47,770 --> 00:10:44,170

Rio Rio did a bunch of statistical tests

270

00:10:50,170 --> 00:10:47,780

and so we may may need to do that and

271

00:10:52,720 --> 00:10:50,180

then finally coming up with a website

272

00:10:55,090 --> 00:10:52,730

examples a bunch of popular level

273

00:10:57,910 --> 00:10:55,100

explanations and I everything has to be

274

00:10:59,920 --> 00:10:57,920

an app doesn't it okay we publish it and

275

00:11:01,330 --> 00:10:59,930

then that's actually not the end because

276

00:11:04,780 --> 00:11:01,340

then we'll actually have the catalog

277

00:11:07,900 --> 00:11:04,790

every claim on the site we're on this

278

00:11:08,280 --> 00:11:07,910

website we would have to actually you

279

00:11:10,469 --> 00:11:08,290

know

280

00:11:11,999 --> 00:11:10,479

not just assume that people are going to

281

00:11:13,319 --> 00:11:12,009

use it but go after people who didn't

282

00:11:15,780 --> 00:11:13,329

use it and say hey could you rate on the

283

00:11:17,369 --> 00:11:15,790

scale encourage media people to ask that

284

00:11:19,679 --> 00:11:17,379

question right you get called up as an

285

00:11:21,239 --> 00:11:19,689

expert and sales and and one of the

286

00:11:23,099 --> 00:11:21,249

questions you're gonna get is hey these

287

00:11:25,999 --> 00:11:23,109

guys you know made this bio signature

288

00:11:29,309 --> 00:11:26,009

what what scale rating do you give it um

289

00:11:33,090 --> 00:11:29,319

so and then I threw in here because

290

00:11:34,559 --> 00:11:33,100

these are going to go up on a on the on

291

00:11:36,059 --> 00:11:34,569

the exit climbs website I've just thrown

292

00:11:38,759 --> 00:11:36,069

in here that the papers that we've been

293

00:11:40,859 --> 00:11:38,769

talking about so far so for the original

294

00:11:43,799 --> 00:11:40,869

Torino scale this is the REO reference

295

00:11:46,829 --> 00:11:43,809

or the couple of REO references there's

296

00:11:48,599 --> 00:11:46,839

an in situ scale that we found the

297

00:11:51,929 --> 00:11:48,609

ladder of life detection which includes

298

00:11:53,219 --> 00:11:51,939

a bunch of NASA executive people and and

299

00:11:54,569 --> 00:11:53,229

some people that probably actually did

300

00:11:56,279 --> 00:11:54,579

the work I don't actually don't know

301  
00:11:59,939 --> 00:11:56,289  
this paper so maybe the nasa execs also

302  
00:12:01,739 --> 00:11:59,949  
did some work and but this is for in

303  
00:12:04,650 --> 00:12:01,749  
situ measurements of life in the solar

304  
00:12:07,169 --> 00:12:04,660  
system and then finally the capping

305  
00:12:09,210 --> 00:12:07,179  
paper and they're actually a pretty good

306  
00:12:11,159 --> 00:12:09,220  
number of wikipedia and other popular

307  
00:12:14,549 --> 00:12:11,169  
articles and sites and so forth which I

308  
00:12:19,320 --> 00:12:14,559  
did in catalog so I will go back to

309  
00:12:19,330 --> 00:12:30,400  
[Applause]

310  
00:12:35,480 --> 00:12:33,770  
tymlerlee yeah in addition to bio

311  
00:12:37,400 --> 00:12:35,490  
signatures on the scale I wonder if we

312  
00:12:39,620 --> 00:12:37,410  
should include pre bio signatures that

313  
00:12:42,590 --> 00:12:39,630

is signatures that prebiotic chemistry

314

00:12:45,320 --> 00:12:42,600

is actually happening things like HCN

315

00:12:48,440 --> 00:12:45,330

detections and other prebiotic molecules

316

00:12:52,220 --> 00:12:48,450

hadn't detections in a habitable zone

317

00:12:55,670 --> 00:12:52,230

planet would so get you up to maybe like

318

00:12:58,040 --> 00:12:55,680

a 1.5 or yeah I mean so this an ocean

319

00:12:59,510 --> 00:12:58,050

wouldn't be the only way to get here and

320

00:13:01,700 --> 00:12:59,520

neither would a terrestrial planet be

321

00:13:03,560 --> 00:13:01,710

the only way to get there this is sort

322

00:13:05,690 --> 00:13:03,570

of the the weight of the evidence is

323

00:13:07,040 --> 00:13:05,700

like you've you've got a rock that might

324

00:13:09,920 --> 00:13:07,050

have the right temperature and then

325

00:13:11,990 --> 00:13:09,930

you've got some some things that we

326

00:13:14,390 --> 00:13:12,000

think should be there and and maybe

327

00:13:15,650 --> 00:13:14,400

maybe something like a prebiotic

328

00:13:17,330 --> 00:13:15,660

chemistry would be in here although I

329

00:13:19,520 --> 00:13:17,340

think anything that can be explained

330

00:13:23,450 --> 00:13:19,530

abiotic Leawood sort of not convince

331

00:13:25,130 --> 00:13:23,460

anybody so well there's HCN supposedly

332

00:13:27,350 --> 00:13:25,140

and some of that Jupiter's maybe that's

333

00:13:29,210 --> 00:13:27,360

too hot I don't know but but but yeah

334

00:13:31,400 --> 00:13:29,220

they I wanted to be really clear that

335

00:13:32,750 --> 00:13:31,410

this is not these are absolutely not the

336

00:13:36,140 --> 00:13:32,760

only ways to get there right these are

337

00:13:37,160 --> 00:13:36,150

these are just examples of ways of

338

00:13:40,850 --> 00:13:37,170

moving on the scale

339

00:13:42,290 --> 00:13:40,860

I came by University of Washington I

340

00:13:44,240 --> 00:13:42,300

just wanted to bring up a few

341

00:13:45,680 --> 00:13:44,250

bookkeeping things first of all I love

342

00:13:46,910 --> 00:13:45,690

this idea I love where this is headed

343

00:13:50,630 --> 00:13:46,920

and I've talked to you about this a

344

00:13:52,490 --> 00:13:50,640

little bit but I would implore us to

345

00:13:53,660 --> 00:13:52,500

open this up to the community even more

346

00:13:55,430 --> 00:13:53,670

and make sure that more of the community

347

00:13:56,690 --> 00:13:55,440

is hearing about it I love EXO going

348

00:13:58,610 --> 00:13:56,700

presence flow and I get to meet all of

349

00:13:59,930 --> 00:13:58,620

you but there's various other of us here

350

00:14:01,430 --> 00:13:59,940

so maybe I don't know if we can talk

351  
00:14:03,350 --> 00:14:01,440  
about this more like Sibelius or

352  
00:14:04,700 --> 00:14:03,360  
something I like make this more public

353  
00:14:06,140 --> 00:14:04,710  
in the meantime that would be really

354  
00:14:08,990 --> 00:14:06,150  
great absolutely and that would ensure

355  
00:14:11,630 --> 00:14:09,000  
that the community would use it also

356  
00:14:14,720 --> 00:14:11,640  
bringing in a philosopher I heard some

357  
00:14:17,750 --> 00:14:14,730  
people scoff and I like the idea of

358  
00:14:19,400 --> 00:14:17,760  
bringing in a science historian there's

359  
00:14:20,570 --> 00:14:19,410  
a lot of insight that those kind of

360  
00:14:22,940 --> 00:14:20,580  
people with those backgrounds can give

361  
00:14:25,040 --> 00:14:22,950  
us and said like how to not screw this

362  
00:14:25,579 --> 00:14:25,050  
up and totally miss communicate with the

363  
00:14:27,980 --> 00:14:25,589

public

364

00:14:32,180 --> 00:14:27,990

in ways that have been done before and

365

00:14:33,440 --> 00:14:32,190

lastly just to think about the balance

366

00:14:34,880 --> 00:14:33,450

of the science impact and you kind of

367

00:14:37,410 --> 00:14:34,890

touched on this not getting too bogged

368

00:14:40,440 --> 00:14:37,420

down with the methods because we may not

369

00:14:42,540 --> 00:14:40,450

anticipate realistically how we detect

370

00:14:44,310 --> 00:14:42,550

these bio signatures and just kind of

371

00:14:49,490 --> 00:14:44,320

broad scale I did I wanted to bring up

372

00:14:56,850 --> 00:14:49,500

with you on thank you yes like fully yes

373

00:14:59,640 --> 00:14:56,860

I also think it's a great idea I have a

374

00:15:02,310 --> 00:14:59,650

question regarding the point two and

375

00:15:07,200 --> 00:15:02,320

three well okay actually a point three

376

00:15:09,660 --> 00:15:07,210

and four so the second one that says a

377

00:15:12,540 --> 00:15:09,670

place life should exist example an ocean

378

00:15:14,580 --> 00:15:12,550

it could be I think an amazing thing to

379

00:15:17,250 --> 00:15:14,590

discover and say that there is an ocean

380

00:15:18,840 --> 00:15:17,260

in such a planet and maybe and the way

381

00:15:21,390 --> 00:15:18,850

that the field is going now it may be

382

00:15:24,270 --> 00:15:21,400

easier to detect by a signature in the

383

00:15:25,950 --> 00:15:24,280

atmosphere so it kind of beast doesn't

384

00:15:28,380 --> 00:15:25,960

reflect the relevance of such a

385

00:15:30,090 --> 00:15:28,390

discovery and I mean may all we can

386

00:15:33,720 --> 00:15:30,100

discuss about I don't think you need an

387

00:15:36,390 --> 00:15:33,730

ocean to get to three I mean if you look

388

00:15:38,940 --> 00:15:36,400

at point two you have place life should

389

00:15:40,980 --> 00:15:38,950

exist in it's written an ocean and then

390

00:15:42,690 --> 00:15:40,990

three and four if the detection of a

391

00:15:44,700 --> 00:15:42,700

single by a signature I mean I kind of

392

00:15:47,040 --> 00:15:44,710

think that the relevance of a discovery

393

00:15:48,570 --> 00:15:47,050

like you might give it a two and then

394

00:15:49,890 --> 00:15:48,580

the people will think this is not

395

00:15:53,220 --> 00:15:49,900

relevant but actually would be an

396

00:15:55,440 --> 00:15:53,230

amazing thing to have you know what I

397

00:15:58,710 --> 00:15:55,450

mean we can be late I'll be happy to

398

00:16:04,140 --> 00:15:58,720

discuss I think the reason we made this

399

00:16:05,730 --> 00:16:04,150

one before that one is that well I don't

400

00:16:09,360 --> 00:16:05,740

I don't know if you have an ocean do you

401  
00:16:13,920 --> 00:16:09,370  
automatically have life no no maybe I

402  
00:16:15,870 --> 00:16:13,930  
don't maybe maybe you know but these

403  
00:16:17,910 --> 00:16:15,880  
things being called bio signatures to be

404  
00:16:20,540 --> 00:16:17,920  
comet being called that because that's

405  
00:16:23,730 --> 00:16:20,550  
supposed to be the only or the principal

406  
00:16:26,640 --> 00:16:23,740  
place you can get that from so if you

407  
00:16:28,470 --> 00:16:26,650  
this is less believable as an indicator

408  
00:16:30,360 --> 00:16:28,480  
of life than that if you get this

409  
00:16:35,280 --> 00:16:30,370  
without that great jump right the three

410  
00:16:36,930 --> 00:16:35,290  
or four if that's not convincing and

411  
00:16:42,140 --> 00:16:36,940  
then I don't understand your point okay

412  
00:16:47,070 --> 00:16:45,150  
regarding the catalog is there a plan

413  
00:16:48,200 --> 00:16:47,080

for like community verification of

414

00:16:50,640 --> 00:16:48,210  
submitted

415

00:16:51,630 --> 00:16:50,650  
constable bio signatures you know

416

00:16:53,130 --> 00:16:51,640  
sending out

417

00:16:54,930 --> 00:16:53,140  
to a maybe book I've been getting

418

00:16:59,220 --> 00:16:54,940  
everyone say yes I agreed it should be a

419

00:17:00,870 --> 00:16:59,230  
5 or the the way the other skills are

420

00:17:02,400 --> 00:17:00,880  
working is that everybody makes their

421

00:17:03,930 --> 00:17:02,410  
own evaluation and the reason for that

422

00:17:05,280 --> 00:17:03,940  
is the press doesn't want to wait weeks

423

00:17:05,699 --> 00:17:05,290  
for you to go and have your committee

424

00:17:09,150 --> 00:17:05,709  
meeting

425

00:17:12,090 --> 00:17:09,160  
so you met you say in your press release

426  
00:17:13,890 --> 00:17:12,100  
we think this is a three and they go and

427  
00:17:15,210 --> 00:17:13,900  
ask experts and the experts say yeah I

428  
00:17:18,780 --> 00:17:15,220  
agree this is the three their experts

429  
00:17:20,910 --> 00:17:18,790  
say no no this is only a one and if that

430  
00:17:23,250 --> 00:17:20,920  
even that disagreement if it is a

431  
00:17:26,040 --> 00:17:23,260  
disagreement is indicative of you know

432  
00:17:34,050 --> 00:17:26,050  
the quality of your of your signal and

433  
00:17:37,050 --> 00:17:34,060  
your and your bio signature that's

434  
00:17:39,780 --> 00:17:37,060  
somebody here to make up this team two

435  
00:17:42,450 --> 00:17:39,790  
quick points firstly my understandings

436  
00:17:44,940 --> 00:17:42,460  
from the from the Rio scale is that like

437  
00:17:47,280 --> 00:17:44,950  
you said they really get high numbers at

438  
00:17:48,930 --> 00:17:47,290

all but that's not because they can't

439

00:17:51,570 --> 00:17:48,940

right now it's just because the criteria

440

00:17:53,850 --> 00:17:51,580

harsh whereas with this criteria some of

441

00:17:57,300 --> 00:17:53,860

those are actually inaccessible to us

442

00:17:58,980 --> 00:17:57,310

for the near future so that's some

443

00:18:01,560 --> 00:17:58,990

that's going to naturally truncate it so

444

00:18:03,810 --> 00:18:01,570

but the other point is that for point

445

00:18:08,700 --> 00:18:03,820

number one I mean one of the issues that

446

00:18:10,080 --> 00:18:08,710

I tend to rage about when it comes to

447

00:18:12,920 --> 00:18:10,090

the abalone because I work on the handle

448

00:18:16,920 --> 00:18:12,930

zone a lot and when we use phrases like

449

00:18:19,920 --> 00:18:16,930

earth-like and temperate planet then

450

00:18:22,350 --> 00:18:19,930

those there's a suggest you know there's

451  
00:18:24,630 --> 00:18:22,360  
a claim there about the knowledge of the

452  
00:18:28,380 --> 00:18:24,640  
surface conditions which we can't back

453  
00:18:30,540 --> 00:18:28,390  
out and so unless we include a

454  
00:18:32,430 --> 00:18:30,550  
constraint on using those kind of

455  
00:18:34,440 --> 00:18:32,440  
phrases you know point number one then

456  
00:18:37,560 --> 00:18:34,450  
we're going to continue to have the kind

457  
00:18:40,380 --> 00:18:37,570  
of hyperbolic press releases that was

458  
00:18:43,560 --> 00:18:40,390  
that's a very good point and I think so

459  
00:18:45,390 --> 00:18:43,570  
maybe what we need to do up here is get

460  
00:18:49,170 --> 00:18:45,400  
specific in the things that we're

461  
00:18:51,990 --> 00:18:49,180  
actually already having and then as as

462  
00:18:54,030 --> 00:18:52,000  
time goes on you know we'll need to do

463  
00:18:57,090 --> 00:18:54,040

that in these other categories and these

464

00:18:58,980 --> 00:18:57,100

sales tend to get revised as science

465

00:19:02,040 --> 00:18:58,990

progresses and so I think we can

466

00:19:03,660 --> 00:19:02,050

probably although I am I fear the

467

00:19:05,370 --> 00:19:03,670

argument but we can probably do

468

00:19:08,550 --> 00:19:05,380

something that's a little bit better

469

00:19:10,680 --> 00:19:08,560

than what's just written here for item

470

00:19:13,080 --> 00:19:10,690

one and possibly even for item two and

471

00:19:14,400 --> 00:19:13,090

then I have no idea what we would do

472

00:19:16,590 --> 00:19:14,410

down here but I don't really care

473

00:19:18,090 --> 00:19:16,600

because if we can I doubt that in my

474

00:19:21,750 --> 00:19:18,100

lifetime we will have a high-resolution

475

00:19:25,020 --> 00:19:21,760

spectrum of a molecule that that you

476

00:19:27,950 --> 00:19:25,030

know on a you know that's complex on on

477

00:19:31,400 --> 00:19:27,960

any planet outside the solar system but

478

00:19:34,800 --> 00:19:31,410

you know so that's the I I think I think

479

00:19:37,110 --> 00:19:34,810

progressing our specificity as time as

480

00:19:38,520 --> 00:19:37,120

time and technology reached the various

481

00:19:43,920 --> 00:19:38,530

points is probably what we need to do

482

00:19:47,010 --> 00:19:43,930

there yeah this is just a follow-on from

483

00:19:48,510 --> 00:19:47,020

Stephens first point that you know as an

484

00:19:49,980 --> 00:19:48,520

observer I look at this and I think you

485

00:19:52,920 --> 00:19:49,990

know we're not gonna get past maybe at

486

00:19:55,830 --> 00:19:52,930

one point five at least five years maybe

487

00:19:57,420 --> 00:19:55,840

ten years yeah and if we so I wanted to

488

00:19:59,760 --> 00:19:57,430

hear in your sessions if you discussed

489

00:20:01,590 --> 00:19:59,770

the timing of when you would want people

490

00:20:02,610 --> 00:20:01,600

to actually start using this scale in

491

00:20:05,370 --> 00:20:02,620

the press do we want to do it

492

00:20:09,180 --> 00:20:05,380

immediately and report once for the next

493

00:20:10,860 --> 00:20:09,190

ten years I I think so I'm not afraid of

494

00:20:12,120 --> 00:20:10,870

having low values for a long time

495

00:20:14,070 --> 00:20:12,130

because everybody knows that the

496

00:20:17,370 --> 00:20:14,080

detection of life is a big deal and not

497

00:20:19,650 --> 00:20:17,380

necessarily happening this year and on

498

00:20:22,080 --> 00:20:19,660

the flip side of it this is the kind of

499

00:20:24,150 --> 00:20:22,090

thing that might get taxpayers to say

500

00:20:26,100 --> 00:20:24,160

you know I really would like to see a

501

00:20:27,660 --> 00:20:26,110

five or six or a seven and they tell us

502

00:20:28,920 --> 00:20:27,670

that if we build this telescope will get

503

00:20:31,260 --> 00:20:28,930

it and so let's do that

504

00:20:33,420 --> 00:20:31,270

and so it might be so the kind of thing