Panelists

Attendees (14)

- Hosts (1)
  - Mike Toillion
- Presenters (2)
  - Andy Burnett
  - Fred Ciesla
- Participants (11)
  - Alycia Weinberger
  - David Des Marais
  - Gavriil
  - guest
  - Guzewich
  - Lindsay Hays
  - MIchael New
  - ron oremland
  - Shawn Domagal-Gold...
  - Steve Vance
  - Tony Del Genio

Open Chat (Everyone)

--------- (10/30/2013 10:57) ---------

Mike Toillion: Please feel free to ask questions or post comments here in the chat room. Thanks!

--------- (10/30/2013 10:59) ---------

Mike Toillion: For audio, please dial-in to the teleconference listed below.

Teleconference Instructions (Parti...

Teleconference Line: 866-692-3158
Passcode: 9109668#
Please use *6 to MUTE your phone's mic when not speaking.
More info: https://astrobiologyfuture.org

Fred Ciesla: How do Habitable Planets Form?

Full Screen

Chemistry of Planet Formation

- The habitability of a planet will be determined, in part, by the availability of key elements and molecules important to life (water, organic molecules, etc). Whether such materials are available to a planet will be determined by the compositions of the building blocks of those planets. Thus, evaluating the likelihood a habitable planet will form around a star requires knowledge of how such molecules form, are processed, and are distributed in planetary systems.

1
00:00:12,870 --> 00:00:10,470
good afternoon everyone um wherever you

2
00:00:15,990 --> 00:00:12,880
may be in the world uh this is the next

3
00:00:17,109 --> 00:00:16,000
in our series of webinars with fred

4
00:00:18,150 --> 00:00:17,119
chesler

5
00:00:20,150 --> 00:00:18,160
um

6
00:00:21,830 --> 00:00:20,160
we are going to be following the same

7
00:00:25,189 --> 00:00:21,840
format we've been using for a little

8
00:00:27,349 --> 00:00:25,199
while which is fred's going to present

9
00:00:29,990 --> 00:00:27,359
as mike said you're more than welcome to

10
00:00:33,030 --> 00:00:30,000
ask questions as you go along the chat

11
00:00:34,229 --> 00:00:33,040
window um seems to work quite well as

12
00:00:37,430 --> 00:00:34,239
that process

13
00:00:40,229 --> 00:00:37,440

when we finish the presentation um we

14
00:00:42,310 --> 00:00:40,239
will invite you if you want to to to

15
00:00:45,270 --> 00:00:42,320
actually open up the mics on your phone

16
00:00:47,430 --> 00:00:45,280
line and talk to us um more than welcome

17
00:00:50,950 --> 00:00:47,440
to do that the whole event is being

18
00:00:53,189 --> 00:00:50,960
recorded it will be online uh shortly

19
00:00:55,110 --> 00:00:53,199
the other thing is that the white paper

20
00:00:57,350 --> 00:00:55,120
that fred is presenting the slides

21
00:01:00,069 --> 00:00:57,360
around at the moment is available in

22
00:01:02,069 --> 00:01:00,079
read-only mode shortly after the end of

23
00:01:03,270 --> 00:01:02,079
this presentation it will be flipped

24
00:01:05,830 --> 00:01:03,280
open

25
00:01:07,670 --> 00:01:05,840
so that you'll be in comment mode if you

26
00:01:09,910 --> 00:01:07,680
haven't used that before it's very

27
00:01:11,910 --> 00:01:09,920
simple all you do is if there are any

28
00:01:13,109 --> 00:01:11,920
parts of the text that you want to

29
00:01:15,109 --> 00:01:13,119
comment on

30
00:01:16,950 --> 00:01:15,119
you simply highlight them and right

31
00:01:18,950 --> 00:01:16,960
click and choose comment and you'll be

32
00:01:20,550 --> 00:01:18,960
able to add the equivalent of little

33
00:01:23,190 --> 00:01:20,560
post-it notes

34
00:01:25,510 --> 00:01:23,200
in the document

35
00:01:27,670 --> 00:01:25,520
that's pretty much about it if you have

36
00:01:29,910 --> 00:01:27,680
any problems or questions uh during the

37
00:01:32,630 --> 00:01:29,920
event please uh just put a question in

38
00:01:35,510 --> 00:01:32,640

the chat window and mike will be able to

39
00:01:37,670 --> 00:01:35,520
assist on any technology issues okay

40
00:01:39,749 --> 00:01:37,680
with that free take it away

41
00:01:41,830 --> 00:01:39,759
all right well good afternoon everybody

42
00:01:43,190 --> 00:01:41,840
um i can see from the participant list

43
00:01:44,710 --> 00:01:43,200
the number of familiar names so it's

44
00:01:46,469 --> 00:01:44,720
nice to see you all and i'm looking

45
00:01:47,670 --> 00:01:46,479
forward to getting getting some feedback

46
00:01:49,670 --> 00:01:47,680
from all of you

47
00:01:50,950 --> 00:01:49,680
and uh giving a little bit of an

48
00:01:52,950 --> 00:01:50,960
overview of some of the issues that

49
00:01:54,950 --> 00:01:52,960
we've been discussing um or at least

50
00:01:57,030 --> 00:01:54,960
that we had discussed this past summer

51
00:01:58,789 --> 00:01:57,040
just to provide a little bit of

52
00:02:00,870 --> 00:01:58,799
background for those of you who may not

53
00:02:02,389 --> 00:02:00,880
have

54
00:02:03,670 --> 00:02:02,399
been completely brought up to date on

55
00:02:05,270 --> 00:02:03,680
what's going on we're trying to

56
00:02:07,190 --> 00:02:05,280
understand what are some of the biggest

57
00:02:09,109 --> 00:02:07,200
issues some of the biggest

58
00:02:11,350 --> 00:02:09,119
research issues that we want to try and

59
00:02:13,110 --> 00:02:11,360
address through the astrobiology program

60
00:02:15,430 --> 00:02:13,120
in the next five to 10 years trying to

61
00:02:17,190 --> 00:02:15,440
identify what are the key milestones

62
00:02:19,350 --> 00:02:17,200
that we want to work towards what we

63
00:02:21,589 --> 00:02:19,360

think is achievable and what the what

64
00:02:23,750 --> 00:02:21,599
the priorities may or may not be

65
00:02:25,350 --> 00:02:23,760
so this summer the way that this began

66
00:02:27,990 --> 00:02:25,360
is we had a

67
00:02:30,309 --> 00:02:28,000
small workshop held where there were

68
00:02:31,910 --> 00:02:30,319
small groups put together

69
00:02:33,910 --> 00:02:31,920
to identify

70
00:02:35,910 --> 00:02:33,920
some of the bigger questions that were

71
00:02:38,390 --> 00:02:35,920
rate that we think are need to be

72
00:02:40,150 --> 00:02:38,400
priorities and over this time frame and

73
00:02:41,670 --> 00:02:40,160
within those bigger questions identify

74
00:02:44,630 --> 00:02:41,680
what some of the smaller questions and

75
00:02:46,470 --> 00:02:44,640
particular milestones uh

76
00:02:48,070 --> 00:02:46,480
what what may be achievable and where

77
00:02:51,030 --> 00:02:48,080
our priorities should be

78
00:02:53,430 --> 00:02:51,040
now because of the workshop being short

79
00:02:54,949 --> 00:02:53,440
and only bringing in a small group of

80
00:02:57,110 --> 00:02:54,959
people from the community

81
00:02:59,350 --> 00:02:57,120
we recognize that this was not going to

82
00:03:01,589 --> 00:02:59,360
be anything close to an exhaustive list

83
00:03:03,270 --> 00:03:01,599
so the goal of today is to give you an

84
00:03:04,710 --> 00:03:03,280
overview of some of the issues that we

85
00:03:06,790 --> 00:03:04,720
identified from the things that we

86
00:03:09,350 --> 00:03:06,800
talked about and open it up to the

87
00:03:11,910 --> 00:03:09,360
community and bring in um

88
00:03:14,470 --> 00:03:11,920

you know get open this up for feedback

89
00:03:16,630 --> 00:03:14,480
on what we did discuss and also identify

90
00:03:18,470 --> 00:03:16,640
things that we didn't um put into the

91
00:03:20,309 --> 00:03:18,480
white paper that also belong there so

92
00:03:23,270 --> 00:03:20,319
this is very much meant to be a

93
00:03:25,190 --> 00:03:23,280
constructive community effort um and so

94
00:03:27,270 --> 00:03:25,200
that's what we're hoping to

95
00:03:28,790 --> 00:03:27,280
get here so what i want to do today is

96
00:03:31,110 --> 00:03:28,800
just highlight one of the bigger

97
00:03:33,270 --> 00:03:31,120
questions that we identified this summer

98
00:03:35,030 --> 00:03:33,280
uh identified kind of what we thought

99
00:03:37,030 --> 00:03:35,040
about the issue how it connected to

100
00:03:39,190 --> 00:03:37,040
other aspects of the astrobiology

101
00:03:41,430 --> 00:03:39,200
program and the research goals that were

102
00:03:43,910 --> 00:03:41,440
identified

103
00:03:45,830 --> 00:03:43,920
and used that really to motivate what

104
00:03:48,470 --> 00:03:45,840
i'm hoping will be more

105
00:03:51,190 --> 00:03:48,480
interactive discussion after my

106
00:03:53,110 --> 00:03:51,200
hopefully very brief presentation

107
00:03:55,910 --> 00:03:53,120
but the big question that we identified

108
00:03:58,309 --> 00:03:55,920
um was how do planet habitable planets

109
00:04:00,229 --> 00:03:58,319
form um and so i'm going to step through

110
00:04:02,309 --> 00:04:00,239
some slides here that mostly provide an

111
00:04:03,509 --> 00:04:02,319
outline of the

112
00:04:08,309 --> 00:04:03,519
uh

113
00:04:09,429 --> 00:04:08,319

just making reference to that everyone

114
00:04:10,869 --> 00:04:09,439
can view

115
00:04:12,390 --> 00:04:10,879
and so the first thing that we started

116
00:04:14,550 --> 00:04:12,400
off with was just a question of what

117
00:04:16,710 --> 00:04:14,560
what do we mean by this why is this an

118
00:04:18,390 --> 00:04:16,720
important question so let's let's start

119
00:04:19,749 --> 00:04:18,400
there uh

120
00:04:22,069 --> 00:04:19,759
one of the things i did was i went to

121
00:04:24,230 --> 00:04:22,079
the actual biology website on nasa and

122
00:04:26,310 --> 00:04:24,240
just tried to take the definition as

123
00:04:28,550 --> 00:04:26,320
it's outlined there and it says that

124
00:04:30,710 --> 00:04:28,560
astrobiology is the study of the origin

125
00:04:32,870 --> 00:04:30,720
evolution distribution and future of

126
00:04:34,790 --> 00:04:32,880
life in the universe and so in terms of

127
00:04:36,710 --> 00:04:34,800
the question of how do habitable planets

128
00:04:38,310 --> 00:04:36,720
form what we're really working to

129
00:04:40,870 --> 00:04:38,320
address here are the latter parts of

130
00:04:42,629 --> 00:04:40,880
that that uh definition that is the

131
00:04:44,950 --> 00:04:42,639
category that falls into the category of

132
00:04:47,430 --> 00:04:44,960
addressing the distribution where might

133
00:04:49,590 --> 00:04:47,440
life be in the universe and what is the

134
00:04:51,670 --> 00:04:49,600
future of life in the universe where

135
00:04:54,790 --> 00:04:51,680
would it survive where could it migrate

136
00:04:57,590 --> 00:04:54,800
to potentially um really whatever our uh

137
00:04:58,629 --> 00:04:57,600
our imaginations allow for

138
00:05:00,390 --> 00:04:58,639

and so

139
00:05:01,990 --> 00:05:00,400
the reason why we wanted specifically to

140
00:05:04,870 --> 00:05:02,000
focus on habitable planets and where

141
00:05:06,310 --> 00:05:04,880
they may exist is one of the amazing

142
00:05:07,909 --> 00:05:06,320
things in my mind that we've come to

143
00:05:09,430 --> 00:05:07,919
recognize in the last few years and

144
00:05:11,270 --> 00:05:09,440
particularly most recently is that

145
00:05:12,390 --> 00:05:11,280
planets are abundant in the galaxy we're

146
00:05:14,310 --> 00:05:12,400
finding them

147
00:05:16,150 --> 00:05:14,320
everywhere we knew they existed

148
00:05:17,909 --> 00:05:16,160
elsewhere for a while but now we're

149
00:05:20,310 --> 00:05:17,919
really beginning to appreciate how

150
00:05:22,230 --> 00:05:20,320
common they are and so this is telling

151
00:05:24,230 --> 00:05:22,240
us that the process by which planets

152
00:05:26,870 --> 00:05:24,240
form you know the general astrophysical

153
00:05:29,270 --> 00:05:26,880
process by which these planets form

154
00:05:31,670 --> 00:05:29,280
it is common and that planets really are

155
00:05:34,070 --> 00:05:31,680
a natural byproduct of surface star

156
00:05:36,310 --> 00:05:34,080
formation something that we tended to

157
00:05:37,990 --> 00:05:36,320
already believe or hope

158
00:05:39,749 --> 00:05:38,000
but now we really have the data that

159
00:05:41,749 --> 00:05:39,759
support that with the with the

160
00:05:43,189 --> 00:05:41,759
identification of how calm these planets

161
00:05:44,790 --> 00:05:43,199
are um

162
00:05:46,629 --> 00:05:44,800
now in terms of habitable planets

163
00:05:48,230 --> 00:05:46,639

however we know that just because you

164
00:05:50,230 --> 00:05:48,240
form planets a planet you're not

165
00:05:51,110 --> 00:05:50,240
necessarily going to form a habitable

166
00:05:53,110 --> 00:05:51,120
planet

167
00:05:54,790 --> 00:05:53,120
and so what we want to begin to address

168
00:05:56,950 --> 00:05:54,800
is how did the details of these

169
00:05:59,110 --> 00:05:56,960
different astrophysical processes and

170
00:06:01,270 --> 00:05:59,120
the sequence of events that led to the

171
00:06:03,670 --> 00:06:01,280
formation of planets how could they have

172
00:06:05,830 --> 00:06:03,680
impacted the properties of the planets

173
00:06:08,390 --> 00:06:05,840
that they do form in terms of where they

174
00:06:10,230 --> 00:06:08,400
are their chemical composition and

175
00:06:11,990 --> 00:06:10,240
whether or not these planets really are

176
00:06:14,150 --> 00:06:12,000
what we would term habitable that is

177
00:06:17,510 --> 00:06:14,160
planets that are capable of allowing

178
00:06:18,629 --> 00:06:17,520
life to form and for that life to

179
00:06:19,990 --> 00:06:18,639
thrive

180
00:06:22,469 --> 00:06:20,000
and so that's what we're looking for

181
00:06:24,950 --> 00:06:22,479
very broadly in terms of habitable

182
00:06:26,629 --> 00:06:24,960
planet formation

183
00:06:27,749 --> 00:06:26,639
so why do we want to understand this

184
00:06:29,350 --> 00:06:27,759
well there's a couple of different

185
00:06:31,510 --> 00:06:29,360
reasons but

186
00:06:33,670 --> 00:06:31,520
our specific goal here is to understand

187
00:06:35,990 --> 00:06:33,680
the physical and chemical processes by

188
00:06:37,510 --> 00:06:36,000

which our own solar system forms um one

189
00:06:39,590 --> 00:06:37,520
thing we take for granted is that we

190
00:06:40,790 --> 00:06:39,600
have a habitable planet in our solar

191
00:06:43,029 --> 00:06:40,800
system but there are still many

192
00:06:44,309 --> 00:06:43,039
questions about its origin and how it

193
00:06:46,309 --> 00:06:44,319
came to be

194
00:06:48,230 --> 00:06:46,319
um so we want to understand how that

195
00:06:50,230 --> 00:06:48,240
happened in our solar system and use

196
00:06:51,430 --> 00:06:50,240
that information to

197
00:06:53,749 --> 00:06:51,440
um

198
00:06:55,590 --> 00:06:53,759
to evaluate how common these type of

199
00:06:58,070 --> 00:06:55,600
processes this formation history that

200
00:06:59,909 --> 00:06:58,080
our solar system experienced how common

201
00:07:02,469 --> 00:06:59,919
these types of processes may be around

202
00:07:05,270 --> 00:07:02,479
other stars or if there are other

203
00:07:07,110 --> 00:07:05,280
uh sequences of events that may lead to

204
00:07:09,189 --> 00:07:07,120
the potential but lead to the formation

205
00:07:11,510 --> 00:07:09,199
of potentially habitable planets and

206
00:07:13,589 --> 00:07:11,520
really this is a necessary step towards

207
00:07:15,189 --> 00:07:13,599
understanding how many habitable planets

208
00:07:17,430 --> 00:07:15,199
there are going to be in the galaxy or

209
00:07:19,589 --> 00:07:17,440
in the universe where those planets may

210
00:07:22,710 --> 00:07:19,599
be and ultimately whether or not there

211
00:07:24,150 --> 00:07:22,720
is life elsewhere in the universe so by

212
00:07:25,749 --> 00:07:24,160
addressing this question we were

213
00:07:27,589 --> 00:07:25,759

beginning to try and understand where

214
00:07:29,430 --> 00:07:27,599
exactly in the universities could be and

215
00:07:31,510 --> 00:07:29,440
how common it would be again going back

216
00:07:34,390 --> 00:07:31,520
to the definition that on the

217
00:07:36,950 --> 00:07:34,400
astrobiology website then

218
00:07:38,870 --> 00:07:36,960
so this is not to men this is not meant

219
00:07:40,710 --> 00:07:38,880
to uh give the impression that this is

220
00:07:43,110 --> 00:07:40,720
going to be an easy test because there

221
00:07:47,510 --> 00:07:43,120
are certainly challenges that we have to

222
00:07:51,270 --> 00:07:49,270
motivated from the questions that we're

223
00:07:53,189 --> 00:07:51,280
going to come to in a little bit

224
00:07:55,350 --> 00:07:53,199
um but some of them are just some things

225
00:07:58,629 --> 00:07:55,360
that we take for granted as well and so

226
00:08:01,670 --> 00:07:58,639
the first is that we don't understand

227
00:08:03,670 --> 00:08:01,680
entirely how our own earth formed or the

228
00:08:05,830 --> 00:08:03,680
conditions by which our planetary system

229
00:08:07,589 --> 00:08:05,840
this is an active area of research

230
00:08:09,909 --> 00:08:07,599
and it's right now we only have one

231
00:08:11,909 --> 00:08:09,919
known habitable planet in the universe

232
00:08:13,670 --> 00:08:11,919
so we do need to understand how that

233
00:08:15,830 --> 00:08:13,680
planet formed we don't immediately just

234
00:08:17,749 --> 00:08:15,840
turn to planets elsewhere assuming that

235
00:08:19,350 --> 00:08:17,759
we can use our earth as a model because

236
00:08:22,150 --> 00:08:19,360
there are details and questions that

237
00:08:23,749 --> 00:08:22,160
need to be filled in

238
00:08:25,909 --> 00:08:23,759

and just the general process of planet

239
00:08:27,830 --> 00:08:25,919
formation we recognize as it is that

240
00:08:29,830 --> 00:08:27,840
it's a very chaotic process with the

241
00:08:31,110 --> 00:08:29,840
outcome spanning sensitively on the

242
00:08:32,709 --> 00:08:31,120
initial conditions

243
00:08:34,709 --> 00:08:32,719
that's how chaotic is

244
00:08:37,110 --> 00:08:34,719
um but

245
00:08:38,870 --> 00:08:37,120
you know what this does is it means that

246
00:08:40,790 --> 00:08:38,880
we have to be very careful in terms of

247
00:08:41,670 --> 00:08:40,800
how we go about addressing this because

248
00:08:43,750 --> 00:08:41,680
people

249
00:08:46,150 --> 00:08:43,760
um the models that we developed to look

250
00:08:49,190 --> 00:08:46,160
at planet formation today

251
00:08:51,110 --> 00:08:49,200
are capable right now of producing many

252
00:08:52,550 --> 00:08:51,120
different outcomes given sight changes

253
00:08:54,470 --> 00:08:52,560
in their initial conditions and that

254
00:08:57,030 --> 00:08:54,480
does just because we don't reproduce our

255
00:08:59,030 --> 00:08:57,040
solar system where we produce different

256
00:09:00,470 --> 00:08:59,040
planet uh different planetary structures

257
00:09:02,230 --> 00:09:00,480
does not mean that those models are

258
00:09:03,990 --> 00:09:02,240
wrong it just means that we may not have

259
00:09:06,310 --> 00:09:04,000
a great understanding of the initial

260
00:09:07,829 --> 00:09:06,320
conditions from which we're starting so

261
00:09:09,910 --> 00:09:07,839
in many ways one of the things that we

262
00:09:12,310 --> 00:09:09,920
have to try and do is look at this as a

263
00:09:14,550 --> 00:09:12,320

probability issue um

264
00:09:17,590 --> 00:09:14,560
given that we're not going to be able to

265
00:09:19,190 --> 00:09:17,600
where we're limited in terms of the

266
00:09:21,829 --> 00:09:19,200
details of the initial conditions

267
00:09:23,910 --> 00:09:21,839
details of some of our starting points

268
00:09:26,070 --> 00:09:23,920
just because we put together a model it

269
00:09:27,350 --> 00:09:26,080
doesn't uh that takes those and moves

270
00:09:29,430 --> 00:09:27,360
forward to make predictions about

271
00:09:30,470 --> 00:09:29,440
habitable planets or the properties of

272
00:09:32,310 --> 00:09:30,480
any planet

273
00:09:33,750 --> 00:09:32,320
if we fail to reproduce

274
00:09:36,230 --> 00:09:33,760
what is observed it doesn't mean that

275
00:09:38,310 --> 00:09:36,240
the planets or those models are wrong or

276
00:09:39,829 --> 00:09:38,320
the processes that we modeled are wrong

277
00:09:41,430 --> 00:09:39,839
it just means that there could be an

278
00:09:43,509 --> 00:09:41,440
issue with the initial condition so this

279
00:09:46,470 --> 00:09:43,519
really is something that requires

280
00:09:48,230 --> 00:09:46,480
detailed interactions between theory and

281
00:09:49,750 --> 00:09:48,240
observations making sure that we have

282
00:09:51,590 --> 00:09:49,760
this interplay

283
00:09:53,110 --> 00:09:51,600
this cross-disciplinary approach to

284
00:09:54,870 --> 00:09:53,120
really use

285
00:09:58,070 --> 00:09:54,880
the different approaches that we in the

286
00:09:59,990 --> 00:09:58,080
community use to educate one another and

287
00:10:02,790 --> 00:10:00,000
work together to make advances towards

288
00:10:05,430 --> 00:10:02,800

answering these questions

289
00:10:07,110 --> 00:10:05,440
and the third uh challenge is that while

290
00:10:09,350 --> 00:10:07,120
we talk about habitable planets in a

291
00:10:11,829 --> 00:10:09,360
very broad sense and the goal ultimately

292
00:10:14,710 --> 00:10:11,839
is to identify planets that may

293
00:10:17,110 --> 00:10:14,720
harbor or allow light to form and evolve

294
00:10:19,110 --> 00:10:17,120
uh we don't necessarily know all the

295
00:10:21,750 --> 00:10:19,120
ingredients or qualities for those have

296
00:10:23,990 --> 00:10:21,760
time we use the earth as a as a model

297
00:10:25,829 --> 00:10:24,000
and that's a natural starting point

298
00:10:28,790 --> 00:10:25,839
because it is the only habitable planet

299
00:10:31,509 --> 00:10:28,800
that we are aware of um but we do have

300
00:10:33,350 --> 00:10:31,519
to be open to the possibility that that

301
00:10:35,430 --> 00:10:33,360
the universe and nature is much more

302
00:10:36,790 --> 00:10:35,440
creative than we are and so we want to

303
00:10:38,710 --> 00:10:36,800
begin to think about the different

304
00:10:40,550 --> 00:10:38,720
processes or different outcomes that you

305
00:10:42,630 --> 00:10:40,560
may get and whether or not they are

306
00:10:44,310 --> 00:10:42,640
conducive to allowing life to form and

307
00:10:46,230 --> 00:10:44,320
evolve and again this requires

308
00:10:48,150 --> 00:10:46,240
interdisciplinary approaches

309
00:10:49,190 --> 00:10:48,160
communication with our biological

310
00:10:51,110 --> 00:10:49,200
colleagues

311
00:10:53,190 --> 00:10:51,120
and not just limiting this to a question

312
00:10:55,750 --> 00:10:53,200
for asterisks business astronomers or

313
00:10:58,389 --> 00:10:55,760

finance companies so this really is a

314
00:11:00,870 --> 00:10:58,399
challenging question but ultimately one

315
00:11:03,190 --> 00:11:00,880
i think that has a high impact and is

316
00:11:05,509 --> 00:11:03,200
important central to one of the the

317
00:11:08,150 --> 00:11:05,519
fields of that style

318
00:11:09,750 --> 00:11:08,160
so because of some of these challenges

319
00:11:11,990 --> 00:11:09,760
and before getting into the details of

320
00:11:15,190 --> 00:11:12,000
some of the questions that we identified

321
00:11:16,949 --> 00:11:15,200
within this particular uh broad question

322
00:11:18,550 --> 00:11:16,959
i do want to point out that there are a

323
00:11:20,790 --> 00:11:18,560
number of related questions that were

324
00:11:22,870 --> 00:11:20,800
identified at our our workshops this

325
00:11:25,030 --> 00:11:22,880
summer and have been discussed or will

326
00:11:26,829 --> 00:11:25,040
be discussed in separate webinars and

327
00:11:29,350 --> 00:11:26,839
i've listed some of them here on this

328
00:11:31,190 --> 00:11:29,360
slide um because i think that it's

329
00:11:33,430 --> 00:11:31,200
important for us to recognize that this

330
00:11:36,069 --> 00:11:33,440
really is a broad question and it

331
00:11:37,190 --> 00:11:36,079
requires um understanding many different

332
00:11:39,990 --> 00:11:37,200
aspects

333
00:11:42,630 --> 00:11:40,000
of of um

334
00:11:43,829 --> 00:11:42,640
of topics within natural biology so we

335
00:11:46,230 --> 00:11:43,839
don't want to look at this as an

336
00:11:48,389 --> 00:11:46,240
isolated question one that we can go

337
00:11:51,190 --> 00:11:48,399
work on independent of one another but

338
00:11:52,550 --> 00:11:51,200

really stress something uh the point

339
00:11:55,110 --> 00:11:52,560
that this is something that's going to

340
00:11:58,310 --> 00:11:55,120
require a community effort to make uh to

341
00:12:00,230 --> 00:11:58,320
make advances and we have to uh be aware

342
00:12:01,990 --> 00:12:00,240
and communicate our ideas across these

343
00:12:04,230 --> 00:12:02,000
questions and not work for the tendency

344
00:12:05,430 --> 00:12:04,240
of one another uh and these questions is

345
00:12:07,509 --> 00:12:05,440
when you get a chance to look at the

346
00:12:09,829 --> 00:12:07,519
white paper these particular related

347
00:12:11,910 --> 00:12:09,839
questions are listed at the end of the

348
00:12:14,230 --> 00:12:11,920
white paper so that um you can come back

349
00:12:16,150 --> 00:12:14,240
to it and if there are webinars that are

350
00:12:18,550 --> 00:12:16,160
uh that haven't taken place i encourage

351
00:12:20,629 --> 00:12:18,560
you to sit in on those as well

352
00:12:25,110 --> 00:12:20,639
because as i said um it will have an

353
00:12:30,870 --> 00:12:26,470
so

354
00:12:32,550 --> 00:12:30,880
that we wanted to address within this

355
00:12:35,990 --> 00:12:32,560
broader question of how do habitable

356
00:12:38,870 --> 00:12:36,000
planets form we identified i think

357
00:12:42,150 --> 00:12:38,880
the slides may prove me wrong um four

358
00:12:45,110 --> 00:12:42,160
major uh sub questions that we

359
00:12:46,629 --> 00:12:45,120
we thought uh needed attention um and

360
00:12:47,509 --> 00:12:46,639
within these sub questions there were

361
00:12:49,430 --> 00:12:47,519
even

362
00:12:51,190 --> 00:12:49,440
a lower level of questions that we

363
00:12:52,629 --> 00:12:51,200

identified and list on the white paper i

364
00:12:54,629 --> 00:12:52,639
didn't want to list all of those on

365
00:12:57,430 --> 00:12:54,639
these slides although i'm hoping that

366
00:12:59,509 --> 00:12:57,440
the text i have here summarizes them

367
00:13:01,269 --> 00:12:59,519
but again i do want to encourage you all

368
00:13:03,269 --> 00:13:01,279
to go through the white paper look at

369
00:13:05,190 --> 00:13:03,279
those and provide comments comments on

370
00:13:07,430 --> 00:13:05,200
the particular questions

371
00:13:10,069 --> 00:13:07,440
and raise questions yourself that you

372
00:13:11,430 --> 00:13:10,079
yourself believe belong on there whether

373
00:13:14,230 --> 00:13:11,440
or not they fall into the broad

374
00:13:15,910 --> 00:13:14,240
questions i identify here or possibly

375
00:13:17,430 --> 00:13:15,920
fall under a needed question that we've

376
00:13:18,949 --> 00:13:17,440
left out

377
00:13:20,629 --> 00:13:18,959
but the first thing that we identify is

378
00:13:23,269 --> 00:13:20,639
just a question of how does planet

379
00:13:24,629 --> 00:13:23,279
formation vary with solar properties

380
00:13:26,389 --> 00:13:24,639
one of the things we typically think

381
00:13:28,230 --> 00:13:26,399
about is an earth-like planet around a

382
00:13:31,190 --> 00:13:28,240
sun-like star and that's where a lot of

383
00:13:32,710 --> 00:13:31,200
our ideas uh and models just from planet

384
00:13:35,190 --> 00:13:32,720
formation alone never mind the question

385
00:13:36,629 --> 00:13:35,200
of habitable habitable planet formation

386
00:13:38,790 --> 00:13:36,639
actually begin

387
00:13:40,949 --> 00:13:38,800
but we recognize that the stars come in

388
00:13:42,790 --> 00:13:40,959

a variety of flavors in the galaxy there

389
00:13:44,710 --> 00:13:42,800
are stars that are much lower mass than

390
00:13:46,790 --> 00:13:44,720
our sun in fact most of the stars in the

391
00:13:48,550 --> 00:13:46,800
galaxy are lower in mass than our sun

392
00:13:50,389 --> 00:13:48,560
there are stars that are higher mass or

393
00:13:52,389 --> 00:13:50,399
stars with different metallicity

394
00:13:53,269 --> 00:13:52,399
different abundances of heavy elements

395
00:13:54,389 --> 00:13:53,279
in them

396
00:13:56,389 --> 00:13:54,399
um

397
00:13:58,550 --> 00:13:56,399
and so these are all issues that are

398
00:14:00,710 --> 00:13:58,560
important and could have an impact on

399
00:14:02,710 --> 00:14:00,720
how planet formation proceeds

400
00:14:04,710 --> 00:14:02,720
uh never mind just this question alone

401
00:14:06,389 --> 00:14:04,720
of habitable planet formation

402
00:14:08,150 --> 00:14:06,399
so we want to understand how these

403
00:14:11,189 --> 00:14:08,160
different processes or these different

404
00:14:12,870 --> 00:14:11,199
qualities of a star could impact

405
00:14:15,269 --> 00:14:12,880
how planet formation would proceed

406
00:14:16,949 --> 00:14:15,279
around these system stars also extending

407
00:14:18,790 --> 00:14:16,959
this to not only just the properties of

408
00:14:20,949 --> 00:14:18,800
the star itself but the environment in

409
00:14:23,509 --> 00:14:20,959
which that star is formed is it born in

410
00:14:25,910 --> 00:14:23,519
a very massive cluster is it foreign and

411
00:14:28,550 --> 00:14:25,920
a low-max cluster or where within those

412
00:14:30,550 --> 00:14:28,560
particular clusters is born all of these

413
00:14:34,310 --> 00:14:30,560

couldn't again impact

414
00:14:37,430 --> 00:14:34,320
the uh the outcome of planetfunness and

415
00:14:40,150 --> 00:14:37,440
again i stress that because of

416
00:14:41,269 --> 00:14:40,160
because of this chaotic nature of planet

417
00:14:43,110 --> 00:14:41,279
formation and

418
00:14:44,710 --> 00:14:43,120
the dependence on the initial conditions

419
00:14:46,790 --> 00:14:44,720
and the

420
00:14:48,710 --> 00:14:46,800
timing and sequence of events that could

421
00:14:50,310 --> 00:14:48,720
occur in these systems it's important

422
00:14:52,150 --> 00:14:50,320
for us to recognize that this is going

423
00:14:54,389 --> 00:14:52,160
to be something that is going to come

424
00:14:56,550 --> 00:14:54,399
down to statistics for example

425
00:14:57,910 --> 00:14:56,560
just speaking very broadly and not not

426
00:14:59,269 --> 00:14:57,920
meaning to motivate a particular

427
00:15:01,990 --> 00:14:59,279
argument here

428
00:15:04,949 --> 00:15:02,000
if we were to find that uh habitable

429
00:15:07,430 --> 00:15:04,959
planet formation or planet formation

430
00:15:09,750 --> 00:15:07,440
tend to produce a planet in the

431
00:15:12,230 --> 00:15:09,760
quote-unquote habitable zone more often

432
00:15:14,230 --> 00:15:12,240
in a star like our sun as opposed to a

433
00:15:16,389 --> 00:15:14,240
low mass star for instance i'm not

434
00:15:18,150 --> 00:15:16,399
fighting any force that suggests that

435
00:15:19,829 --> 00:15:18,160
um that doesn't mean that we should

436
00:15:21,910 --> 00:15:19,839
completely rule out the possibility of

437
00:15:23,590 --> 00:15:21,920
habitable planets around low mass stars

438
00:15:26,150 --> 00:15:23,600

it just means that the statistics are

439
00:15:27,750 --> 00:15:26,160
likely but may be low however given the

440
00:15:29,750 --> 00:15:27,760
fact that low mass stars are so much

441
00:15:33,030 --> 00:15:29,760
more abundant they still may be more

442
00:15:34,790 --> 00:15:33,040
attractive in terms of um looking for

443
00:15:36,389 --> 00:15:34,800
habitable planet formation just due to

444
00:15:37,990 --> 00:15:36,399
those numbers involved

445
00:15:39,990 --> 00:15:38,000
so these are the things that we need to

446
00:15:42,710 --> 00:15:40,000
try and quantify and look at if we

447
00:15:44,790 --> 00:15:42,720
eventually want to look for identifying

448
00:15:46,710 --> 00:15:44,800
searching for habitable planets in the

449
00:15:48,870 --> 00:15:46,720
galaxy by understanding how these

450
00:15:51,430 --> 00:15:48,880
processes operate around just stars of

451
00:15:54,389 --> 00:15:51,440
different types we may be able to

452
00:15:56,069 --> 00:15:54,399
educate and motivate future studies and

453
00:15:57,670 --> 00:15:56,079
provide guidance as to where these

454
00:15:59,110 --> 00:15:57,680
studies should be sober

455
00:16:01,030 --> 00:15:59,120
um so again

456
00:16:02,389 --> 00:16:01,040
understanding how these things depend on

457
00:16:04,710 --> 00:16:02,399
the properties of central stars

458
00:16:05,590 --> 00:16:04,720
important things

459
00:16:08,790 --> 00:16:05,600
um

460
00:16:10,310 --> 00:16:08,800
one thing that is particularly close to

461
00:16:11,670 --> 00:16:10,320
my interest but

462
00:16:13,110 --> 00:16:11,680
something that we recognize as being

463
00:16:14,470 --> 00:16:13,120

very important in the workshop that

464
00:16:16,949 --> 00:16:14,480
we've had this summer was the

465
00:16:19,430 --> 00:16:16,959
recognition that uh chemistry of planet

466
00:16:21,030 --> 00:16:19,440
formation is often handed handled

467
00:16:23,350 --> 00:16:21,040
separately from the physical planet

468
00:16:25,990 --> 00:16:23,360
formation we outline a sequence of

469
00:16:29,430 --> 00:16:26,000
events as to how planets would form

470
00:16:31,030 --> 00:16:29,440
starting with the syllabus our cloud for

471
00:16:32,870 --> 00:16:31,040
formation of a disk

472
00:16:34,629 --> 00:16:32,880
coagulation of dust performing science

473
00:16:37,030 --> 00:16:34,639
testimonies and those scientifically

474
00:16:38,949 --> 00:16:37,040
performed planets we talk about those

475
00:16:41,189 --> 00:16:38,959
very generically and then we start

476
00:16:43,749 --> 00:16:41,199
looking at how chemistry would

477
00:16:45,509 --> 00:16:43,759
be affected by these different causes

478
00:16:47,350 --> 00:16:45,519
but there's really going to be an

479
00:16:49,110 --> 00:16:47,360
intimate feedback that occurs between

480
00:16:51,590 --> 00:16:49,120
the chemical and the cysts or evolution

481
00:16:52,710 --> 00:16:51,600
of materials throughout all these

482
00:16:54,870 --> 00:16:52,720
processes

483
00:16:57,269 --> 00:16:54,880
as things begin to vaporize as they are

484
00:16:59,030 --> 00:16:57,279
brought across close to the sun their

485
00:17:01,030 --> 00:16:59,040
chemical properties are going to change

486
00:17:03,430 --> 00:17:01,040
and therefore what they could then be

487
00:17:05,590 --> 00:17:03,440
incorporated into at later stages of

488
00:17:07,829 --> 00:17:05,600

evolution are going to be important

489
00:17:09,750 --> 00:17:07,839
um and in many ways this is important in

490
00:17:11,909 --> 00:17:09,760
terms of starting um

491
00:17:13,350 --> 00:17:11,919
or helping to establish what the initial

492
00:17:15,189 --> 00:17:13,360
conditions are

493
00:17:16,789 --> 00:17:15,199
at the different phases of evolution

494
00:17:18,630 --> 00:17:16,799
that we often study

495
00:17:20,949 --> 00:17:18,640
our things process

496
00:17:23,189 --> 00:17:20,959
when the molecular cloud core collapses

497
00:17:25,590 --> 00:17:23,199
form the protoplanetary disk how much of

498
00:17:27,750 --> 00:17:25,600
the molecular cloud material is the rex

499
00:17:29,510 --> 00:17:27,760
cancer it is how much of it is destroyed

500
00:17:30,870 --> 00:17:29,520
during that formation

501
00:17:32,950 --> 00:17:30,880
and this is going to be important in

502
00:17:34,870 --> 00:17:32,960
terms of setting things like the

503
00:17:36,950 --> 00:17:34,880
abundances of organics within the photo

504
00:17:38,870 --> 00:17:36,960
scientists or the ability of different

505
00:17:40,230 --> 00:17:38,880
molecules to take part in chemistry

506
00:17:42,789 --> 00:17:40,240
within them

507
00:17:44,549 --> 00:17:42,799
and so this is again an important

508
00:17:46,390 --> 00:17:44,559
feedback you need to understand how

509
00:17:47,510 --> 00:17:46,400
these two things are really coupled as

510
00:17:48,710 --> 00:17:47,520
opposed to

511
00:17:50,870 --> 00:17:48,720
separate

512
00:17:52,470 --> 00:17:50,880
um now i can talk completely without

513
00:17:54,470 --> 00:17:52,480

even using the text on my side so i want

514
00:17:56,950 --> 00:17:54,480
to make sure that i haven't produced no

515
00:17:59,110 --> 00:17:56,960
point uh any of the points here but

516
00:18:00,950 --> 00:17:59,120
again you know looking at how the

517
00:18:04,070 --> 00:18:00,960
physical processes set the initial

518
00:18:05,830 --> 00:18:04,080
distribution of materials within a

519
00:18:07,270 --> 00:18:05,840
different epics of planet formation is

520
00:18:09,750 --> 00:18:07,280
going to be important because this

521
00:18:11,270 --> 00:18:09,760
really will set

522
00:18:13,190 --> 00:18:11,280
the inventory of materials that are

523
00:18:15,029 --> 00:18:13,200
potentially delivered to a habitable

524
00:18:17,909 --> 00:18:15,039
planet and whether or not that habitable

525
00:18:20,230 --> 00:18:17,919
planet can excrete the key elements and

526
00:18:23,830 --> 00:18:20,240
volatiles that we think are necessary to

527
00:18:25,909 --> 00:18:23,840
deform agents and development of life

528
00:18:28,310 --> 00:18:25,919
right next slide the roles of giant

529
00:18:29,990 --> 00:18:28,320
planets this is an important one um in

530
00:18:31,590 --> 00:18:30,000
many ways because giant planets are

531
00:18:33,590 --> 00:18:31,600
exciting because they're easier to see

532
00:18:35,350 --> 00:18:33,600
around other stars than the small

533
00:18:38,310 --> 00:18:35,360
virtual planets that we typically think

534
00:18:40,150 --> 00:18:38,320
of as being close for less

535
00:18:41,669 --> 00:18:40,160
again i stress typically because i don't

536
00:18:43,510 --> 00:18:41,679
want to limit ourselves

537
00:18:45,750 --> 00:18:43,520
to any particular

538
00:18:48,549 --> 00:18:45,760

dogma or ideas out there recommend that

539
00:18:50,950 --> 00:18:48,559
there's a lot of possibilities out there

540
00:18:52,630 --> 00:18:50,960
um but giant planets in our own solar

541
00:18:54,710 --> 00:18:52,640
system we are

542
00:18:56,150 --> 00:18:54,720
seeing that what happened with jupiter

543
00:18:59,350 --> 00:18:56,160
and saturn would have had a somatic

544
00:19:01,590 --> 00:18:59,360
effect in terms of how the formation of

545
00:19:04,150 --> 00:19:01,600
the earth and these and mars and venus

546
00:19:06,470 --> 00:19:04,160
would have proceeded in the inner solar

547
00:19:08,830 --> 00:19:06,480
um in many cases you can still form

548
00:19:11,350 --> 00:19:08,840
planets at least regardless of

549
00:19:13,430 --> 00:19:11,360
the uh details of what happens with

550
00:19:15,990 --> 00:19:13,440
future status but in terms of the

551
00:19:18,630 --> 00:19:16,000
appreciation history and where material

552
00:19:20,230 --> 00:19:18,640
is brought from to be treated into these

553
00:19:22,549 --> 00:19:20,240
precious planets it does have an

554
00:19:24,549 --> 00:19:22,559
important effect in terms of when these

555
00:19:27,430 --> 00:19:24,559
planets form whether or not they've

556
00:19:29,350 --> 00:19:27,440
migrated and to what extent they migrate

557
00:19:31,909 --> 00:19:29,360
and there's even beyond that the issue

558
00:19:33,990 --> 00:19:31,919
of what role did jupiter play in the

559
00:19:37,029 --> 00:19:34,000
subsequent evolution of the planetary

560
00:19:39,669 --> 00:19:37,039
system in terms of stabilizing the orbit

561
00:19:41,750 --> 00:19:39,679
and possibly removing the debris that

562
00:19:43,510 --> 00:19:41,760
was left over from the formation of the

563
00:19:45,430 --> 00:19:43,520

planet these debris could have

564
00:19:47,909 --> 00:19:45,440
potentially posed hazards to the

565
00:19:50,470 --> 00:19:47,919
formation and development of life um if

566
00:19:51,350 --> 00:19:50,480
you think about like an ap type impact

567
00:19:53,750 --> 00:19:51,360
um

568
00:19:55,669 --> 00:19:53,760
in many cases we worry about how impacts

569
00:19:58,390 --> 00:19:55,679
from this leftover debris could

570
00:20:00,230 --> 00:19:58,400
sterilize the surface of a planet um if

571
00:20:02,950 --> 00:20:00,240
there was significant income tax over

572
00:20:06,710 --> 00:20:02,960
time um but also the potential for you

573
00:20:08,630 --> 00:20:06,720
know if those late uh impacts were

574
00:20:10,630 --> 00:20:08,640
maybe beneficial

575
00:20:12,470 --> 00:20:10,640
in that they delivered volatility

576
00:20:14,310 --> 00:20:12,480
elements to stellar most likes we don't

577
00:20:16,310 --> 00:20:14,320
want to say necessarily say that

578
00:20:18,710 --> 00:20:16,320
removing all that degree isn't

579
00:20:20,630 --> 00:20:18,720
necessary and maybe jupiter's presence

580
00:20:22,470 --> 00:20:20,640
was helpful in that it excited the

581
00:20:24,870 --> 00:20:22,480
orbits of some things that were brought

582
00:20:28,470 --> 00:20:24,880
to earth that then played a key role in

583
00:20:30,310 --> 00:20:28,480
allowing flight to gain hold on

584
00:20:32,789 --> 00:20:30,320
uh so we want to understand

585
00:20:35,510 --> 00:20:32,799
how did giant planets affect all these

586
00:20:37,190 --> 00:20:35,520
things and then what types of orbits or

587
00:20:39,909 --> 00:20:37,200
structures or properties of giant

588
00:20:41,909 --> 00:20:39,919

planets may be uh

589
00:20:44,149 --> 00:20:41,919
conducive to the formation and

590
00:20:45,750 --> 00:20:44,159
maintenance of the habitable planets

591
00:20:47,669 --> 00:20:45,760
versus what

592
00:20:49,750 --> 00:20:47,679
properties may be

593
00:20:51,510 --> 00:20:49,760
problematic and therefore

594
00:20:53,669 --> 00:20:51,520
by detecting

595
00:20:56,310 --> 00:20:53,679
giant planets maybe you can outright

596
00:20:58,630 --> 00:20:56,320
exclude the possibility for a habitable

597
00:21:00,149 --> 00:20:58,640
planet existing in the united states so

598
00:21:01,029 --> 00:21:00,159
there's a lot of open-ended questions

599
00:21:02,710 --> 00:21:01,039
there

600
00:21:05,270 --> 00:21:02,720
and we do identify some of those in the

601
00:21:07,270 --> 00:21:05,280
white paper um but there's uh you know

602
00:21:08,789 --> 00:21:07,280
when we just think of formation of

603
00:21:10,310 --> 00:21:08,799
habitable planets i think it's important

604
00:21:11,990 --> 00:21:10,320
for us to also think about what else is

605
00:21:14,149 --> 00:21:12,000
going on in that planetary system and

606
00:21:16,549 --> 00:21:14,159
how could it impact both the shortness

607
00:21:20,789 --> 00:21:16,559
of formation and the long-term evolution

608
00:21:24,870 --> 00:21:21,990
and then the other thing that we

609
00:21:27,350 --> 00:21:24,880
identified is recognizing that

610
00:21:29,510 --> 00:21:27,360
we're at a very important point in terms

611
00:21:30,470 --> 00:21:29,520
of observational data that can be

612
00:21:33,029 --> 00:21:30,480
collected

613
00:21:34,870 --> 00:21:33,039

there's a number of new facilities that

614
00:21:36,470 --> 00:21:34,880
have just come online or will be coming

615
00:21:39,029 --> 00:21:36,480
online or made available in the coming

616
00:21:41,029 --> 00:21:39,039
years both ground-based and safe space

617
00:21:43,029 --> 00:21:41,039
and these are going to provide new

618
00:21:46,149 --> 00:21:43,039
opportunities to make new observations

619
00:21:48,070 --> 00:21:46,159
that have today been uh

620
00:21:51,350 --> 00:21:48,080
technologically

621
00:21:53,110 --> 00:21:51,360
uh limited and uh not unavailable

622
00:21:54,630 --> 00:21:53,120
so what we want to do is recognize in

623
00:21:57,110 --> 00:21:54,640
the short term in the next five to ten

624
00:21:59,029 --> 00:21:57,120
years what kind of information can we

625
00:22:01,029 --> 00:21:59,039
really tease from the observations that

626
00:22:03,430 --> 00:22:01,039
will be made from these facilities and

627
00:22:05,029 --> 00:22:03,440
then how can we use that information

628
00:22:07,110 --> 00:22:05,039
to further

629
00:22:09,350 --> 00:22:07,120
uh educate our ideas on how planets

630
00:22:11,510 --> 00:22:09,360
forms test the models and hypotheses

631
00:22:13,110 --> 00:22:11,520
that are developed as we look at some of

632
00:22:15,430 --> 00:22:13,120
these other questions that have been

633
00:22:17,510 --> 00:22:15,440
identified or are identified in the

634
00:22:19,669 --> 00:22:17,520
future on these white papers

635
00:22:20,950 --> 00:22:19,679
to really maximize the scientific return

636
00:22:22,230 --> 00:22:20,960
then

637
00:22:24,310 --> 00:22:22,240
looking at

638
00:22:26,390 --> 00:22:24,320

the connections between some of the uh

639
00:22:28,789 --> 00:22:26,400
the the observations that will be made

640
00:22:29,750 --> 00:22:28,799
in the issues related to habitability

641
00:22:32,390 --> 00:22:29,760
um

642
00:22:34,390 --> 00:22:32,400
because ultimately we want to uh

643
00:22:36,070 --> 00:22:34,400
again maximize the scientific

644
00:22:38,070 --> 00:22:36,080
return and understand where habitable

645
00:22:39,909 --> 00:22:38,080
planets should or do exist within the

646
00:22:41,830 --> 00:22:39,919
galaxy and then be able to make the

647
00:22:43,510 --> 00:22:41,840
observations of those planets and start

648
00:22:44,470 --> 00:22:43,520
to really understand what this planet

649
00:22:46,950 --> 00:22:44,480
looks like

650
00:22:50,070 --> 00:22:46,960
and by maximizing all of our our

651
00:22:51,750 --> 00:22:50,080
observational and modeling efforts um

652
00:23:01,669 --> 00:22:51,760
that's how we're going to take a step

653
00:23:05,990 --> 00:23:04,549
outside of our own planetary system

654
00:23:07,750 --> 00:23:06,000
um

655
00:23:09,029 --> 00:23:07,760
and so this is just the final slide here

656
00:23:11,430 --> 00:23:09,039
and then now what i want to do is open

657
00:23:13,029 --> 00:23:11,440
it up with discussion but you know those

658
00:23:14,950 --> 00:23:13,039
were the four basic questions that we

659
00:23:17,270 --> 00:23:14,960
identified and as i said those were not

660
00:23:18,950 --> 00:23:17,280
meant to be exhausted in any sort of way

661
00:23:21,270 --> 00:23:18,960
we recognize that there's many more out

662
00:23:23,510 --> 00:23:21,280
there and we want to get the feedback

663
00:23:25,110 --> 00:23:23,520

and i help identify what did we miss or

664
00:23:27,510 --> 00:23:25,120
where should the priorities be in the

665
00:23:29,909 --> 00:23:27,520
different questions that we did um

666
00:23:31,510 --> 00:23:29,919
did identify but really

667
00:23:33,190 --> 00:23:31,520
one of the key points that i want to go

668
00:23:34,950 --> 00:23:33,200
back to is why are we studying this why

669
00:23:38,149 --> 00:23:34,960
do we care about this and why do we want

670
00:23:39,669 --> 00:23:38,159
to understand habitable planet formation

671
00:23:41,830 --> 00:23:39,679
and why did we recognize that as being

672
00:23:43,270 --> 00:23:41,840
an important part of a potentially

673
00:23:45,190 --> 00:23:43,280
important part of the roadmap moving

674
00:23:46,950 --> 00:23:45,200
forward and the first is that it just

675
00:23:48,310 --> 00:23:46,960
completes the story of our own origins

676
00:23:49,750 --> 00:23:48,320
it's you know one of two of the

677
00:23:51,590 --> 00:23:49,760
fundamental questions that we're always

678
00:23:53,510 --> 00:23:51,600
asking in science where did we come from

679
00:23:55,510 --> 00:23:53,520
and where are we going so understanding

680
00:23:56,789 --> 00:23:55,520
how a habitable planet forms means

681
00:23:58,470 --> 00:23:56,799
understanding where they are from and

682
00:24:01,510 --> 00:23:58,480
understanding where we came from and how

683
00:24:03,750 --> 00:24:01,520
we fit within the gal within the

684
00:24:06,230 --> 00:24:03,760
the milky way and so i think that's just

685
00:24:07,990 --> 00:24:06,240
a fundamentally important question uh

686
00:24:10,710 --> 00:24:08,000
from a scientific perspective and from a

687
00:24:12,789 --> 00:24:10,720
philosophical um perspective and to me

688
00:24:14,789 --> 00:24:12,799

that's one of the things that i'm really

689
00:24:15,990 --> 00:24:14,799
excited about here in terms of being

690
00:24:17,430 --> 00:24:16,000
able to possibly work towards

691
00:24:19,830 --> 00:24:17,440
understanding

692
00:24:21,750 --> 00:24:19,840
um again it allows us to understand our

693
00:24:23,029 --> 00:24:21,760
place in the galaxy we can

694
00:24:25,190 --> 00:24:23,039
address the question of how many

695
00:24:26,950 --> 00:24:25,200
habitable planets there are in scale

696
00:24:28,710 --> 00:24:26,960
where else are they

697
00:24:30,710 --> 00:24:28,720
and how do they compare to the earth and

698
00:24:32,710 --> 00:24:30,720
do they potentially

699
00:24:35,110 --> 00:24:32,720
harbor life so it told us where we

700
00:24:36,390 --> 00:24:35,120
should be looking for lifestyles and to

701
00:24:37,909 --> 00:24:36,400
me these are some of the most exciting

702
00:24:40,390 --> 00:24:37,919
things that we can begin to be working

703
00:24:42,390 --> 00:24:40,400
on on why we should be most why we

704
00:24:43,990 --> 00:24:42,400
should be looking at these questions but

705
00:24:45,990 --> 00:24:44,000
it is important to recognize that we

706
00:24:47,590 --> 00:24:46,000
don't need to jump to these fraudus

707
00:24:50,630 --> 00:24:47,600
goals this is what's motivating it but

708
00:24:52,630 --> 00:24:50,640
there's a lot of important um benchmarks

709
00:24:54,390 --> 00:24:52,640
we need to meet along the way some of

710
00:24:56,630 --> 00:24:54,400
which we just identified and hopefully

711
00:24:58,789 --> 00:24:56,640
some of which will identify as these uh

712
00:25:00,870 --> 00:24:58,799
successions that they have here

713
00:25:02,630 --> 00:25:00,880

so what i would like to do as i said i

714
00:25:03,990 --> 00:25:02,640
think that's yes that is the final slide

715
00:25:05,510 --> 00:25:04,000
here i'd like to open it up to

716
00:25:08,070 --> 00:25:05,520
discussion i see andy's coming back

717
00:25:09,909 --> 00:25:08,080
online um and however that's going to be

718
00:25:11,590 --> 00:25:09,919
whether we open the phone lines or open

719
00:25:13,269 --> 00:25:11,600
the chat window but uh hopefully we'll

720
00:25:15,269 --> 00:25:13,279
have a

721
00:25:16,789 --> 00:25:15,279
productive conversation i look forward

722
00:25:18,870 --> 00:25:16,799
to very funny

723
00:25:19,669 --> 00:25:18,880
great thank you fred um

724
00:25:21,669 --> 00:25:19,679
so

725
00:25:23,909 --> 00:25:21,679
uh for anyone who hasn't been to one of

726
00:25:27,350 --> 00:25:23,919
these before what we found works quite

727
00:25:29,750 --> 00:25:27,360
well is by all means type your question

728
00:25:32,310 --> 00:25:29,760
into the chat window uh if that's

729
00:25:36,310 --> 00:25:32,320
easiest for you um but the phone lines

730
00:25:39,190 --> 00:25:36,320
are open and if you want to to talk

731
00:25:41,110 --> 00:25:39,200
directly up i always have to do this the

732
00:25:43,190 --> 00:25:41,120
right way up at the top of the bar there

733
00:25:45,909 --> 00:25:43,200
you'll see a little icon of somebody

734
00:25:47,669 --> 00:25:45,919
with their hand in the air and uh if you

735
00:25:49,590 --> 00:25:47,679
click on that it just gives us an

736
00:25:53,029 --> 00:25:49,600
indication that we can we can bring you

737
00:25:57,110 --> 00:25:53,039
into the audio call so uh so dave has uh

738
00:25:59,190 --> 00:25:57,120

has taken first bite at it um

739
00:26:00,310 --> 00:25:59,200
well thank you dave

740
00:26:01,990 --> 00:26:00,320
i always like to start off with a

741
00:26:05,029 --> 00:26:02,000
compliment um

742
00:26:07,190 --> 00:26:05,039
yeah no um i think many people we were

743
00:26:09,190 --> 00:26:07,200
given some very broad guidelines and i

744
00:26:11,269 --> 00:26:09,200
think michael is typing so he can give

745
00:26:14,870 --> 00:26:11,279
some uh overview

746
00:26:17,510 --> 00:26:14,880
as to uh yeah we were kind of given a

747
00:26:19,029 --> 00:26:17,520
general template with which to work um

748
00:26:20,470 --> 00:26:19,039
and so i don't know what other people

749
00:26:22,390 --> 00:26:20,480
have done for the white papers

750
00:26:24,549 --> 00:26:22,400
completely i've seen a few others but i

751
00:26:26,230 --> 00:26:24,559
think the general format here is fairly

752
00:26:27,350 --> 00:26:26,240
common

753
00:26:31,590 --> 00:26:27,360
great

754
00:26:34,390 --> 00:26:31,600
other questions or observations um what

755
00:26:37,909 --> 00:26:34,400
else might the team find useful to be

756
00:26:40,789 --> 00:26:37,919
aware of or think about in terms of this

757
00:26:42,630 --> 00:26:40,799
paper and also what might it connect to

758
00:26:44,789 --> 00:26:42,640
your own thinking if you're involved in

759
00:26:47,669 --> 00:26:44,799
writing papers have you seen connections

760
00:26:48,710 --> 00:26:47,679
there that would be useful to identify

761
00:26:50,950 --> 00:26:48,720
all right

762
00:26:52,470 --> 00:26:50,960
yeah i'd be very interested to see you

763
00:26:55,909 --> 00:26:52,480

know some of the things that people are

764
00:26:57,990 --> 00:26:55,919
thinking of that we neglected in terms

765
00:26:59,430 --> 00:26:58,000
of what we've identified here or things

766
00:27:01,269 --> 00:26:59,440
that you think are particularly

767
00:27:02,870 --> 00:27:01,279
important maybe that we have

768
00:27:04,830 --> 00:27:02,880
identified but you want to make sure are

769
00:27:07,669 --> 00:27:04,840
stressed as being fundamentally

770
00:27:10,149 --> 00:27:07,679
important um and as i said this is this

771
00:27:11,830 --> 00:27:10,159
really was a team effort um and so i'm

772
00:27:14,549 --> 00:27:11,840
just representing the team here but i

773
00:27:18,149 --> 00:27:14,559
see steve vance's on here and he was one

774
00:27:20,470 --> 00:27:18,159
of the co-authors of this white paper

775
00:27:21,750 --> 00:27:20,480
as were steve moises and alan boss and

776
00:27:22,549 --> 00:27:21,760
rory barnes

777
00:27:24,870 --> 00:27:22,559
um

778
00:27:26,390 --> 00:27:24,880
but as we said this is not a complete

779
00:27:28,549 --> 00:27:26,400
sampling of the community so there's

780
00:27:30,789 --> 00:27:28,559
going to be many things uh many other

781
00:27:33,190 --> 00:27:30,799
viewpoints that people have so i'd like

782
00:27:34,710 --> 00:27:33,200
to hear them

783
00:27:36,789 --> 00:27:34,720
well i have another question that's sort

784
00:27:38,630 --> 00:27:36,799
of generically related to that and that

785
00:27:40,310 --> 00:27:38,640
is at the very top level the title of

786
00:27:42,390 --> 00:27:40,320
your document you feel very strongly

787
00:27:44,630 --> 00:27:42,400
that this should be included in the in

788
00:27:47,350 --> 00:27:44,640

the strategy document and then maybe as

789
00:27:48,950 --> 00:27:47,360
we go down to the next level uh you'd

790
00:27:50,789 --> 00:27:48,960
like to think that in your biggest

791
00:27:52,470 --> 00:27:50,799
headings in your in your document that

792
00:27:53,990 --> 00:27:52,480
you've really captured the breadth of

793
00:27:55,029 --> 00:27:54,000
this area i mean at some point at the

794
00:27:56,310 --> 00:27:55,039
top end

795
00:27:59,430 --> 00:27:56,320
you've got to feel like you've really

796
00:28:01,510 --> 00:27:59,440
defined the perimeter of this area but

797
00:28:02,470 --> 00:28:01,520
then as you drop down maybe to your sub

798
00:28:03,350 --> 00:28:02,480
questions

799
00:28:04,789 --> 00:28:03,360
uh

800
00:28:06,870 --> 00:28:04,799
you're in a mode where these are

801
00:28:08,389 --> 00:28:06,880
examples of questions but that's not the

802
00:28:10,310 --> 00:28:08,399
unexhausted list you see what i'm

803
00:28:11,590 --> 00:28:10,320
getting at i mean that at some point at

804
00:28:13,750 --> 00:28:11,600
the upper end you really feel like

805
00:28:15,669 --> 00:28:13,760
you've captured it all but as you drop

806
00:28:17,590 --> 00:28:15,679
down to a lower level you're just giving

807
00:28:20,149 --> 00:28:17,600
examples so that the others don't think

808
00:28:22,230 --> 00:28:20,159
they're being excluded necessarily so

809
00:28:24,310 --> 00:28:22,240
how do you feel how that plays out in

810
00:28:26,870 --> 00:28:24,320
what you presented today

811
00:28:28,389 --> 00:28:26,880
um well first uh i'm sorry my

812
00:28:29,830 --> 00:28:28,399
recognition isn't very good could you

813
00:28:31,990 --> 00:28:29,840

identify who you were i think that was

814
00:28:34,149 --> 00:28:32,000
dave wasn't it

815
00:28:35,430 --> 00:28:34,159
right yeah all right

816
00:28:42,630 --> 00:28:35,440
um

817
00:28:44,470 --> 00:28:42,640
whether or not you should think of the

818
00:28:46,549 --> 00:28:44,480
document as being complete

819
00:28:48,389 --> 00:28:46,559
um i would say that

820
00:28:49,909 --> 00:28:48,399
we recognized that there were going to

821
00:28:51,830 --> 00:28:49,919
be things that needed to be added and

822
00:28:55,190 --> 00:28:51,840
needed to be kind of integrated into

823
00:28:56,950 --> 00:28:55,200
everything that we identified and so uh

824
00:28:58,870 --> 00:28:56,960
we when we were working on the document

825
00:29:01,190 --> 00:28:58,880
we weren't trying to tie everything

826
00:29:03,510 --> 00:29:01,200
together at the end to show bring it

827
00:29:05,510 --> 00:29:03,520
back to that top level argument that as

828
00:29:07,190 --> 00:29:05,520
you identified um and that's something

829
00:29:09,669 --> 00:29:07,200
that does need to be done i agree with

830
00:29:11,350 --> 00:29:09,679
you um and so

831
00:29:13,350 --> 00:29:11,360
again that the document is going to be

832
00:29:16,310 --> 00:29:13,360
something that continues to be worked on

833
00:29:18,070 --> 00:29:16,320
and edited um and ultimately the paper

834
00:29:20,310 --> 00:29:18,080
uh and i don't know if michael wants to

835
00:29:22,789 --> 00:29:20,320
comment on it now but again this is all

836
00:29:25,590 --> 00:29:22,799
ultimately meant to be useful in terms

837
00:29:27,350 --> 00:29:25,600
of guiding the development of a road map

838
00:29:28,230 --> 00:29:27,360

or strategy as i understand it this

839
00:29:29,510 --> 00:29:28,240
isn't

840
00:29:31,590 --> 00:29:29,520
something that's going to be stapled

841
00:29:34,710 --> 00:29:31,600
together with the other white papers to

842
00:29:36,789 --> 00:29:34,720
represent the the

843
00:29:39,430 --> 00:29:36,799
represent the final

844
00:29:41,110 --> 00:29:39,440
word on what the astrobiology program is

845
00:29:43,110 --> 00:29:41,120
doing um

846
00:29:45,110 --> 00:29:43,120
but i i agree with you it's important to

847
00:29:46,950 --> 00:29:45,120
bring that all back together and once

848
00:29:48,470 --> 00:29:46,960
we've we feel like we've got a more

849
00:29:50,549 --> 00:29:48,480
complete list that the community is

850
00:29:53,430 --> 00:29:50,559
happy with we'll work to integrate it

851
00:29:55,350 --> 00:29:53,440
together to complete that story

852
00:29:57,669 --> 00:29:55,360
but i think it's a good point and i

853
00:29:59,350 --> 00:29:57,679
thank you for the feedback there

854
00:30:01,190 --> 00:29:59,360
let me just say it a different way and

855
00:30:02,870 --> 00:30:01,200
that is at the very top of your document

856
00:30:05,029 --> 00:30:02,880
at the biggest highest level you're

857
00:30:07,350 --> 00:30:05,039
really defining for people what the

858
00:30:08,950 --> 00:30:07,360
field is what this part of the field is

859
00:30:10,789 --> 00:30:08,960
and that's very educational and then at

860
00:30:12,310 --> 00:30:10,799
the somewhere in the middle

861
00:30:13,990 --> 00:30:12,320
you're you're beginning to set

862
00:30:15,750 --> 00:30:14,000
priorities for what you think really

863
00:30:17,830 --> 00:30:15,760

should be done in the next five years so

864
00:30:19,750 --> 00:30:17,840
you're necessarily narrowing it down a

865
00:30:21,430 --> 00:30:19,760
bit look okay this is the whole field

866
00:30:23,590 --> 00:30:21,440
but this is really what we need to deal

867
00:30:25,029 --> 00:30:23,600
with in the next five five years or ten

868
00:30:27,110 --> 00:30:25,039
years or whatever and then at the bottom

869
00:30:29,430 --> 00:30:27,120
level you're giving just examples not

870
00:30:30,950 --> 00:30:29,440
not not inc all-inclusive but examples

871
00:30:32,789 --> 00:30:30,960
of how you might proceed you see what

872
00:30:35,029 --> 00:30:32,799
i'm getting at you're sort of

873
00:30:37,909 --> 00:30:35,039
grading from being all inclusive to

874
00:30:39,669 --> 00:30:37,919
prioritizing to giving examples and

875
00:30:41,430 --> 00:30:39,679
and i see how you can do that with your

876
00:30:44,470 --> 00:30:41,440
structure here and that's why i like it

877
00:30:46,070 --> 00:30:44,480
um but i just you know so i think maybe

878
00:30:48,710 --> 00:30:46,080
if there's needs to be input at this

879
00:30:50,470 --> 00:30:48,720
level it's in this area what really is

880
00:30:52,389 --> 00:30:50,480
important for the next five to ten years

881
00:30:55,110 --> 00:30:52,399
sort of that middle tier in the

882
00:30:57,269 --> 00:30:55,120
organization and if there's any sort of

883
00:30:59,269 --> 00:30:57,279
feedback where people feel that there

884
00:31:01,669 --> 00:30:59,279
needs to be input

885
00:31:04,630 --> 00:31:01,679
you would seem to me that that's the key

886
00:31:06,870 --> 00:31:04,640
key point keep part of the document

887
00:31:10,070 --> 00:31:06,880
so i i in developing these i think you

888
00:31:11,990 --> 00:31:10,080

know i agree with you that um or

889
00:31:14,710 --> 00:31:12,000
the way we were thinking about it is

890
00:31:17,110 --> 00:31:14,720
that it is important to kind of identify

891
00:31:18,710 --> 00:31:17,120
both the broad picture and also kind of

892
00:31:21,750 --> 00:31:18,720
identify the fact that there are

893
00:31:23,510 --> 00:31:21,760
tractable uh or achievable goals in the

894
00:31:26,070 --> 00:31:23,520
short term um because this roadmap is

895
00:31:28,630 --> 00:31:26,080
meant to kind of educate or eliminate

896
00:31:30,470 --> 00:31:28,640
what we should be working on next but uh

897
00:31:32,470 --> 00:31:30,480
maybe one thing we can do at the end of

898
00:31:33,830 --> 00:31:32,480
identifying those kind of

899
00:31:35,510 --> 00:31:33,840
fine questions

900
00:31:37,430 --> 00:31:35,520
is have some discussion about how they

901
00:31:38,870 --> 00:31:37,440
would fit into addressing the broader

902
00:31:40,870 --> 00:31:38,880
goals and the bigger picture that we

903
00:31:42,389 --> 00:31:40,880
outline at the top level and kind of

904
00:31:44,710 --> 00:31:42,399
bring it back to show that how this

905
00:31:46,149 --> 00:31:44,720
would all fit together um

906
00:31:47,830 --> 00:31:46,159
is that something that you kind of fits

907
00:31:50,549 --> 00:31:47,840
with what you're describing there did i

908
00:31:52,470 --> 00:31:50,559
understand that properly

909
00:31:53,269 --> 00:31:52,480
yeah yeah yeah it's just you know it's

910
00:31:55,350 --> 00:31:53,279
just

911
00:31:56,470 --> 00:31:55,360
the the this combination of objectives

912
00:31:58,470 --> 00:31:56,480
that you're uh

913
00:32:00,149 --> 00:31:58,480

of you know things you're trying to

914
00:32:02,630 --> 00:32:00,159
achieve you know the

915
00:32:04,310 --> 00:32:02,640
general definition of what this area is

916
00:32:05,909 --> 00:32:04,320
you know where you guys see the

917
00:32:07,590 --> 00:32:05,919
priorities in the next five to ten years

918
00:32:09,269 --> 00:32:07,600
and then just giving people examples of

919
00:32:10,870 --> 00:32:09,279
things that could be done that moves in

920
00:32:12,070 --> 00:32:10,880
that direction and that that's not

921
00:32:14,389 --> 00:32:12,080
totally

922
00:32:16,230 --> 00:32:14,399
exhaustive list um and and and then i

923
00:32:16,950 --> 00:32:16,240
like your sort of coming back at the end

924
00:32:20,070 --> 00:32:16,960
to

925
00:32:22,310 --> 00:32:20,080
things that motivate us

926
00:32:23,750 --> 00:32:22,320
you know those are always valuable parts

927
00:32:25,990 --> 00:32:23,760
of a document like this i mean this

928
00:32:26,630 --> 00:32:26,000
document is intended to motivate as much

929
00:32:31,590 --> 00:32:26,640
as

930
00:32:35,830 --> 00:32:32,789
and that'll be something we'll be

931
00:32:38,310 --> 00:32:35,840
mindful as we develop these um yeah we

932
00:32:40,310 --> 00:32:38,320
have a well-loved voice here yeah i see

933
00:32:42,149 --> 00:32:40,320
alicia weinberger uh typed some

934
00:32:43,830 --> 00:32:42,159
questions into the chat um trying to

935
00:32:44,870 --> 00:32:43,840
figure out the bounds of astrobiology

936
00:32:46,710 --> 00:32:44,880
and this is an excellent question

937
00:32:48,710 --> 00:32:46,720
because this is something that we

938
00:32:50,789 --> 00:32:48,720

somewhat uh wrestled with ourselves in

939
00:32:52,950 --> 00:32:50,799
having these discussions so her

940
00:32:54,950 --> 00:32:52,960
questions are for some examples are

941
00:32:57,110 --> 00:32:54,960
observations of circumcis are there

942
00:32:59,750 --> 00:32:57,120
observations of circumstellar discs that

943
00:33:01,110 --> 00:32:59,760
would not be relevant um given that

944
00:33:02,710 --> 00:33:01,120
you know these discs are eventually

945
00:33:04,549 --> 00:33:02,720
going to form planets

946
00:33:06,149 --> 00:33:04,559
um could you imagine something that's

947
00:33:08,149 --> 00:33:06,159
going to be a measurement that isn't

948
00:33:10,549 --> 00:33:08,159
going to be have some impact on whether

949
00:33:13,509 --> 00:33:10,559
or not habitable planets would form or

950
00:33:15,430 --> 00:33:13,519
other questions related to astrobiology

951
00:33:17,029 --> 00:33:15,440
what observation

952
00:33:19,509 --> 00:33:17,039
of young stars themselves would be

953
00:33:22,310 --> 00:33:19,519
relevant for example abundances magnetic

954
00:33:23,909 --> 00:33:22,320
fields flaring rates and alicia i think

955
00:33:25,350 --> 00:33:23,919
that's an excellent question um that's

956
00:33:27,669 --> 00:33:25,360
something we wrestled with as well

957
00:33:30,389 --> 00:33:27,679
because it's kind of in and

958
00:33:32,549 --> 00:33:30,399
um i don't know that i myself am capable

959
00:33:34,310 --> 00:33:32,559
or in the position to

960
00:33:36,149 --> 00:33:34,320
discuss what the balance are but i can

961
00:33:39,190 --> 00:33:36,159
offer my opinion and hopefully other

962
00:33:41,750 --> 00:33:39,200
people will chime in as well um

963
00:33:42,630 --> 00:33:41,760

i think it's hard to say something is

964
00:33:44,710 --> 00:33:42,640
you know when you're talking about

965
00:33:46,230 --> 00:33:44,720
something as broad as planet formation

966
00:33:47,830 --> 00:33:46,240
um when you're talking about how stars

967
00:33:48,870 --> 00:33:47,840
form or plants form

968
00:33:50,549 --> 00:33:48,880
um

969
00:33:52,870 --> 00:33:50,559
clearly those that's an important thing

970
00:33:54,950 --> 00:33:52,880
to understand towards how uh how

971
00:33:58,630 --> 00:33:54,960
habitable planets uh would eventually

972
00:34:00,070 --> 00:33:58,640
form um you know i i'm i wouldn't go all

973
00:34:02,630 --> 00:34:00,080
the way back to saying the big bang is

974
00:34:04,310 --> 00:34:02,640
necessary to understand uh in terms of

975
00:34:06,149 --> 00:34:04,320
astrobiology even though that was

976
00:34:07,830 --> 00:34:06,159
clearly what set everything in motion to

977
00:34:08,869 --> 00:34:07,840
eventually lead to the formation of half

978
00:34:11,270 --> 00:34:08,879
of the planet

979
00:34:13,909 --> 00:34:11,280
and so there is this question as to what

980
00:34:16,149 --> 00:34:13,919
are the um what are the bounds and so

981
00:34:18,950 --> 00:34:16,159
the argument i would make is that if you

982
00:34:21,750 --> 00:34:18,960
can demonstrate in asking that question

983
00:34:23,430 --> 00:34:21,760
how that data for example taking your

984
00:34:25,030 --> 00:34:23,440
first question how an observation of a

985
00:34:28,149 --> 00:34:25,040
certain stellar disk

986
00:34:32,389 --> 00:34:30,470
help us better understand the questions

987
00:34:34,230 --> 00:34:32,399
of habitable planet formation or whether

988
00:34:36,629 --> 00:34:34,240

or not these hypoplanets form or the

989
00:34:38,710 --> 00:34:36,639
connection between circumstellar disks

990
00:34:39,510 --> 00:34:38,720
and the potential for life forming in

991
00:34:42,389 --> 00:34:39,520
these

992
00:34:43,669 --> 00:34:42,399
planetary systems i think that you know

993
00:34:45,109 --> 00:34:43,679
that falls within the realms of

994
00:34:47,349 --> 00:34:45,119
astrobiology if you're just trying to

995
00:34:50,069 --> 00:34:47,359
understand

996
00:34:51,270 --> 00:34:50,079
the surface density distribution

997
00:34:53,109 --> 00:34:51,280
because you want to look at planet

998
00:34:54,869 --> 00:34:53,119
migration yes you could always make that

999
00:34:56,230 --> 00:34:54,879
connection but

1000
00:34:57,990 --> 00:34:56,240
i don't know

1001
00:35:00,710 --> 00:34:58,000
it's something we wrestled with and as

1002
00:35:02,310 --> 00:35:00,720
he sees this typing so hopefully he can

1003
00:35:05,270 --> 00:35:02,320
remember some of the conversation we had

1004
00:35:06,790 --> 00:35:05,280
this summer about it but um it is a very

1005
00:35:07,910 --> 00:35:06,800
gray area

1006
00:35:09,270 --> 00:35:07,920
um and i think that's one of the things

1007
00:35:10,710 --> 00:35:09,280
that makes actual biology very

1008
00:35:12,790 --> 00:35:10,720
interesting but also

1009
00:35:14,790 --> 00:35:12,800
leads to um

1010
00:35:16,710 --> 00:35:14,800
since it's so open like that it's hard

1011
00:35:18,150 --> 00:35:16,720
to completely uh

1012
00:35:19,750 --> 00:35:18,160
know where something ends and something

1013
00:35:21,750 --> 00:35:19,760

else picks up

1014
00:35:23,510 --> 00:35:21,760
i think that steve if it's if it's

1015
00:35:26,310 --> 00:35:23,520
convenient for you can

1016
00:35:31,829 --> 00:35:26,320
unmute your phone and talk rather than

1017
00:35:36,470 --> 00:35:34,230
yeah i i'm in a shared environment so i

1018
00:35:38,710 --> 00:35:36,480
won't uh i won't speak for too long but

1019
00:35:40,390 --> 00:35:38,720
uh yeah we we touched on magnetic fields

1020
00:35:42,390 --> 00:35:40,400
around other other solar systems we

1021
00:35:45,430 --> 00:35:42,400
didn't really know what to do

1022
00:35:46,950 --> 00:35:45,440
as i recall from our meeting um but i

1023
00:35:47,990 --> 00:35:46,960
attended this kiss workshop that i

1024
00:35:50,950 --> 00:35:48,000
linked to

1025
00:35:52,790 --> 00:35:50,960
uh subsequent to our meeting i found it

1026
00:35:55,109 --> 00:35:52,800
really hugely exciting that the workshop

1027
00:35:57,030 --> 00:35:55,119
focused on the possibility of measuring

1028
00:35:58,630 --> 00:35:57,040
magnetic fields around

1029
00:35:59,750 --> 00:35:58,640
blue planet

1030
00:36:01,829 --> 00:35:59,760
and maybe that's something that could

1031
00:36:03,670 --> 00:36:01,839
occur in the next decade um it didn't

1032
00:36:05,109 --> 00:36:03,680
really make it into our document but i

1033
00:36:08,710 --> 00:36:05,119
hope it

1034
00:36:10,710 --> 00:36:08,720
figures into discussions down the road

1035
00:36:12,470 --> 00:36:10,720
great thank you

1036
00:36:14,069 --> 00:36:12,480
yeah so this is alicia if i can just

1037
00:36:15,750 --> 00:36:14,079
jump in verbally

1038
00:36:18,710 --> 00:36:15,760

please do

1039
00:36:20,790 --> 00:36:18,720
so i would argue for an expansive

1040
00:36:23,589 --> 00:36:20,800
definition of astrobiology when it comes

1041
00:36:24,870 --> 00:36:23,599
to astronomy and part of this is

1042
00:36:26,390 --> 00:36:24,880
just from

1043
00:36:27,750 --> 00:36:26,400
my bias that i don't think there's

1044
00:36:30,630 --> 00:36:27,760
enough astronomy in the current

1045
00:36:32,870 --> 00:36:30,640
astrobiology institute that the

1046
00:36:34,390 --> 00:36:32,880
astronomical questions that we ask are

1047
00:36:35,190 --> 00:36:34,400
so central

1048
00:36:37,829 --> 00:36:35,200
to

1049
00:36:40,790 --> 00:36:37,839
whether or not there are other habitable

1050
00:36:43,030 --> 00:36:40,800
planets that that has to be considered a

1051
00:36:45,829 --> 00:36:43,040
core part of the astrobiology institute

1052
00:36:47,589 --> 00:36:45,839
and so even questions like

1053
00:36:49,829 --> 00:36:47,599
general questions of giant planet

1054
00:36:52,950 --> 00:36:49,839
migration i would argue are also

1055
00:36:54,870 --> 00:36:52,960
essential in your example fred because

1056
00:36:57,190 --> 00:36:54,880
without understanding the migration of

1057
00:37:00,150 --> 00:36:57,200
the giant planets we have no idea what

1058
00:37:02,870 --> 00:37:00,160
systems we can currently find that might

1059
00:37:04,630 --> 00:37:02,880
also host habitable planets

1060
00:37:05,990 --> 00:37:04,640
right so we have a certain census

1061
00:37:07,910 --> 00:37:06,000
already and we don't know whether that

1062
00:37:09,670 --> 00:37:07,920
census is likely to include a high

1063
00:37:11,750 --> 00:37:09,680

fraction or a low fraction of planets

1064
00:37:14,870 --> 00:37:11,760
that we don't detect but which could

1065
00:37:17,270 --> 00:37:14,880
actually be habitable so i would err on

1066
00:37:18,150 --> 00:37:17,280
the side of letting people

1067
00:37:22,109 --> 00:37:18,160
you know

1068
00:37:23,910 --> 00:37:22,119
write their own expansive connections to

1069
00:37:25,990 --> 00:37:23,920
astrobiological questions from an

1070
00:37:29,670 --> 00:37:26,000
astronomical perspective but i was

1071
00:37:31,109 --> 00:37:29,680
curious what you guys had discussed

1072
00:37:32,710 --> 00:37:31,119
no i and i think

1073
00:37:35,589 --> 00:37:32,720
i think you make excellent points alicia

1074
00:37:37,670 --> 00:37:35,599
and you know your your view it was

1075
00:37:40,069 --> 00:37:37,680
shared at the conference by some of the

1076
00:37:42,710 --> 00:37:40,079
participants and i'm being very general

1077
00:37:44,630 --> 00:37:42,720
and and not stating

1078
00:37:46,710 --> 00:37:44,640
my own personal biases that completely

1079
00:37:48,150 --> 00:37:46,720
agree with you um but

1080
00:37:50,230 --> 00:37:48,160
um you know

1081
00:37:52,150 --> 00:37:50,240
i think it's one of those things where

1082
00:37:53,670 --> 00:37:52,160
whenever you have a very broad field

1083
00:37:56,390 --> 00:37:53,680
like this something that is very

1084
00:37:57,349 --> 00:37:56,400
interdisciplinary um

1085
00:37:58,390 --> 00:37:57,359
it is

1086
00:37:59,990 --> 00:37:58,400
uh

1087
00:38:02,150 --> 00:38:00,000
there's a potential for a lot of things

1088
00:38:04,230 --> 00:38:02,160

to feedback and be important in all this

1089
00:38:06,230 --> 00:38:04,240
um and i think what's important is that

1090
00:38:08,390 --> 00:38:06,240
we have to demonstrate

1091
00:38:10,390 --> 00:38:08,400
as moving forward how particular

1092
00:38:12,950 --> 00:38:10,400
observations or studies

1093
00:38:15,910 --> 00:38:12,960
are going to further the understanding

1094
00:38:17,829 --> 00:38:15,920
of the question of life elsewhere um so

1095
00:38:19,750 --> 00:38:17,839
from the sake of wanting to know how

1096
00:38:21,510 --> 00:38:19,760
magnetic fields impact

1097
00:38:23,829 --> 00:38:21,520
planetary migration for example yes

1098
00:38:25,430 --> 00:38:23,839
planetary migration is important and so

1099
00:38:28,310 --> 00:38:25,440
i think it's up to the people to

1100
00:38:29,829 --> 00:38:28,320
demonstrate how that ultimately leads to

1101
00:38:31,750 --> 00:38:29,839
an understanding of habitable planet

1102
00:38:34,150 --> 00:38:31,760
formation rather than just saying

1103
00:38:35,190 --> 00:38:34,160
well anytime you talk about a planet

1104
00:38:36,630 --> 00:38:35,200
you're talking about have the

1105
00:38:38,710 --> 00:38:36,640
possibility of being related to half

1106
00:38:41,270 --> 00:38:38,720
those planet formation i think it's up

1107
00:38:42,630 --> 00:38:41,280
to us to continue the thought process

1108
00:38:44,150 --> 00:38:42,640
all the way through

1109
00:38:45,910 --> 00:38:44,160
um

1110
00:38:48,790 --> 00:38:45,920
and demonstrating in terms of that's the

1111
00:38:50,550 --> 00:38:48,800
astrobiology program how this impacts uh

1112
00:38:53,030 --> 00:38:50,560
substantial ability of

1113
00:38:55,190 --> 00:38:53,040

potential for life to be for having

1114
00:38:56,710 --> 00:38:55,200
planets to be affected by the processes

1115
00:38:58,829 --> 00:38:56,720
we study

1116
00:39:02,790 --> 00:38:58,839
i hope i hope that makes

1117
00:39:04,150 --> 00:39:02,800
sense but i i do agree

1118
00:39:06,790 --> 00:39:04,160
i'd like to direct a question at

1119
00:39:08,550 --> 00:39:06,800
headquarters on this and that is that uh

1120
00:39:10,150 --> 00:39:08,560
these are all very important things for

1121
00:39:13,430 --> 00:39:10,160
the science mission directorate of nasa

1122
00:39:14,630 --> 00:39:13,440
to be supporting but i guess my basic

1123
00:39:16,550 --> 00:39:14,640
question is what what does the

1124
00:39:18,390 --> 00:39:16,560
astrobiology program want out of this

1125
00:39:19,990 --> 00:39:18,400
document that gives them guidance as to

1126
00:39:21,910 --> 00:39:20,000
how their program

1127
00:39:24,069 --> 00:39:21,920
will make its particular emphasis or

1128
00:39:27,510 --> 00:39:24,079
contribution to this overall

1129
00:39:30,950 --> 00:39:28,950
um you know

1130
00:39:32,870 --> 00:39:30,960
i i guess i'm still trying i'm trying to

1131
00:39:36,069 --> 00:39:32,880
understand what you're asking

1132
00:39:39,910 --> 00:39:36,079
uh we're looking for a description of

1133
00:39:41,430 --> 00:39:39,920
exciting future areas of this of this

1134
00:39:44,470 --> 00:39:41,440
this field

1135
00:39:45,510 --> 00:39:44,480
and that will naturally

1136
00:39:50,630 --> 00:39:45,520
impact

1137
00:39:54,950 --> 00:39:50,640
run

1138
00:39:57,670 --> 00:39:54,960

it'll impact how we try to

1139
00:40:00,150 --> 00:39:57,680
sell astrobiology to other parts of nasa

1140
00:40:01,430 --> 00:40:00,160
and so on i guess

1141
00:40:04,470 --> 00:40:01,440
if you're asking me is there going to be

1142
00:40:07,349 --> 00:40:04,480
a one-to-one mapping between uh

1143
00:40:09,190 --> 00:40:07,359
major topics in this document and calls

1144
00:40:12,150 --> 00:40:09,200
for proposals or something i mean the

1145
00:40:14,470 --> 00:40:12,160
answer there is probably not

1146
00:40:20,550 --> 00:40:17,030
i'm looking we're looking for

1147
00:40:20,560 --> 00:40:24,069
guidance

1148
00:40:27,430 --> 00:40:25,910
just across the broad field of planet

1149
00:40:29,030 --> 00:40:27,440
formation and then

1150
00:40:31,510 --> 00:40:29,040
from that you sort of do you mean

1151
00:40:35,030 --> 00:40:31,520
particularly in planet formation

1152
00:40:35,990 --> 00:40:35,040
well how do planets form yeah i mean

1153
00:40:38,710 --> 00:40:36,000
right

1154
00:40:40,310 --> 00:40:38,720
i mean we heard about uh research that

1155
00:40:41,829 --> 00:40:40,320
addresses all the aspects of what

1156
00:40:44,069 --> 00:40:41,839
happens in a disc

1157
00:40:45,270 --> 00:40:44,079
uh and um you know they're all very

1158
00:40:46,950 --> 00:40:45,280
relevant to the formation of the

1159
00:40:48,150 --> 00:40:46,960
habitable planet um

1160
00:40:50,630 --> 00:40:48,160
is

1161
00:40:52,710 --> 00:40:50,640
something that

1162
00:40:55,430 --> 00:40:52,720
all of which the astrobiology program

1163
00:40:57,349 --> 00:40:55,440

will will support or or

1164
00:40:59,670 --> 00:40:57,359
or what i don't know i mean i'm just

1165
00:41:01,910 --> 00:40:59,680
trying to keep it as an open question

1166
00:41:03,990 --> 00:41:01,920
um i i

1167
00:41:06,230 --> 00:41:04,000
so i think there's two issues the first

1168
00:41:08,230 --> 00:41:06,240
is

1169
00:41:10,150 --> 00:41:08,240
what are the open questions that are

1170
00:41:12,630 --> 00:41:10,160
related to astrobiology and the second

1171
00:41:14,150 --> 00:41:12,640
is what

1172
00:41:16,230 --> 00:41:14,160
particular

1173
00:41:17,750 --> 00:41:16,240
topics is the astrobiology program going

1174
00:41:18,870 --> 00:41:17,760
to fund and those are not necessarily

1175
00:41:20,230 --> 00:41:18,880
the same

1176
00:41:22,230 --> 00:41:20,240
so there are certainly going to be some

1177
00:41:25,270 --> 00:41:22,240
aspects of planet formation such as

1178
00:41:27,430 --> 00:41:25,280
giant planet formation for example which

1179
00:41:30,069 --> 00:41:27,440
astrobiology program in and of itself

1180
00:41:31,510 --> 00:41:30,079
may not fund but certainly

1181
00:41:33,910 --> 00:41:31,520
other parts of the planetary science

1182
00:41:35,270 --> 00:41:33,920
division at nasa will fund we already

1183
00:41:37,109 --> 00:41:35,280
fund them in the origins of solar

1184
00:41:37,990 --> 00:41:37,119
systems program

1185
00:41:39,349 --> 00:41:38,000
um

1186
00:41:40,790 --> 00:41:39,359
but those kinds of decisions are

1187
00:41:42,470 --> 00:41:40,800
downstream from this document we

1188
00:41:44,710 --> 00:41:42,480

shouldn't worry about that

1189
00:41:46,230 --> 00:41:44,720
absolutely correct these are downstream

1190
00:41:48,470 --> 00:41:46,240
these are going to be regularly

1191
00:41:50,790 --> 00:41:48,480
reassessed at headquarters i wouldn't

1192
00:41:52,630 --> 00:41:50,800
worry about it in this document your the

1193
00:41:53,910 --> 00:41:52,640
purpose of the document is

1194
00:41:54,710 --> 00:41:53,920
to

1195
00:41:57,430 --> 00:41:54,720
give

1196
00:42:01,430 --> 00:41:59,349
skeleton

1197
00:42:04,150 --> 00:42:01,440
on which the community as a whole will

1198
00:42:08,470 --> 00:42:04,160
build the next decade of uh

1199
00:42:15,589 --> 00:42:11,510
okay frank do you do you want to pick up

1200
00:42:18,790 --> 00:42:15,599
on uh alyssia and gabriel's points at

1201
00:42:21,190 --> 00:42:18,800
all in the checked window um well i feel

1202
00:42:22,550 --> 00:42:21,200
i was just going back to the slides here

1203
00:42:27,109 --> 00:42:22,560
to

1204
00:42:29,510 --> 00:42:27,119
a potential missing item from the white

1205
00:42:31,190 --> 00:42:29,520
paper what measurements must be made

1206
00:42:33,349 --> 00:42:31,200
prior to the design and launch of a

1207
00:42:35,589 --> 00:42:33,359
mission to take spectra of terrestrial

1208
00:42:37,670 --> 00:42:35,599
planets in habitable zones

1209
00:42:39,990 --> 00:42:37,680
um and so the some of the other

1210
00:42:41,829 --> 00:42:40,000
questions that were identified at the uh

1211
00:42:44,550 --> 00:42:41,839
at the workshop and there will be some

1212
00:42:46,950 --> 00:42:44,560
discussion um may actually

1213
00:42:49,430 --> 00:42:46,960

be related to that and this is you know

1214
00:42:51,510 --> 00:42:49,440
this is a good place for us to have this

1215
00:42:54,069 --> 00:42:51,520
dialogue um does something like that

1216
00:42:56,470 --> 00:42:54,079
fall more into this uh fraud question or

1217
00:42:58,470 --> 00:42:56,480
something like the question of how would

1218
00:43:00,950 --> 00:42:58,480
we identify and recognize a habitable

1219
00:43:02,470 --> 00:43:00,960
planet um that was a separate question

1220
00:43:05,829 --> 00:43:02,480
that i believe is going to have its own

1221
00:43:08,470 --> 00:43:05,839
webinar um or it's being folded into

1222
00:43:10,390 --> 00:43:08,480
another one down the road um

1223
00:43:13,190 --> 00:43:10,400
how would we recognize an inhabited

1224
00:43:14,870 --> 00:43:13,200
planet those types of things um so

1225
00:43:15,829 --> 00:43:14,880
alicia's question is

1226
00:43:17,109 --> 00:43:15,839
about

1227
00:43:19,190 --> 00:43:17,119
you know

1228
00:43:20,390 --> 00:43:19,200
launching a mission that would actually

1229
00:43:22,790 --> 00:43:20,400
observe

1230
00:43:23,910 --> 00:43:22,800
uh planets in their habitable zones

1231
00:43:25,829 --> 00:43:23,920
um

1232
00:43:27,349 --> 00:43:25,839
and so does that relate to the formation

1233
00:43:28,630 --> 00:43:27,359
or does that relate to some of these

1234
00:43:29,750 --> 00:43:28,640
questions here

1235
00:43:31,510 --> 00:43:29,760
um

1236
00:43:34,150 --> 00:43:31,520
so sean just commented that there will

1237
00:43:36,950 --> 00:43:34,160
be webinars on sexual interpretations of

1238
00:43:41,190 --> 00:43:39,270

so so um i don't know alicia if that

1239
00:43:42,870 --> 00:43:41,200
satisfies your your comment there or if

1240
00:43:45,589 --> 00:43:42,880
you feel like that should be discussed

1241
00:43:50,230 --> 00:43:47,910
well for example one current item right

1242
00:43:52,230 --> 00:43:50,240
is the detection of how much terrestrial

1243
00:43:54,710 --> 00:43:52,240
zone dust there is through projects like

1244
00:43:57,190 --> 00:43:54,720
lbti right that was considered essential

1245
00:43:58,630 --> 00:43:57,200
information for for designing a future

1246
00:44:00,550 --> 00:43:58,640
mission that's happening in the present

1247
00:44:01,750 --> 00:44:00,560
so it doesn't necessarily need to go on

1248
00:44:03,910 --> 00:44:01,760
the roadmap

1249
00:44:06,069 --> 00:44:03,920
but my thinking was more are there

1250
00:44:07,430 --> 00:44:06,079
similar questions

1251
00:44:09,109 --> 00:44:07,440
that

1252
00:44:11,030 --> 00:44:09,119
we would require the answers to for

1253
00:44:13,109 --> 00:44:11,040
mission-driven reasons as opposed just

1254
00:44:14,790 --> 00:44:13,119
from pure scientific reasons

1255
00:44:16,150 --> 00:44:14,800
right and there's lots of people

1256
00:44:17,510 --> 00:44:16,160
thinking about those missions who would

1257
00:44:19,030 --> 00:44:17,520
have a better answer to that question

1258
00:44:20,230 --> 00:44:19,040
than me

1259
00:44:22,150 --> 00:44:20,240
and

1260
00:44:24,950 --> 00:44:22,160
they would have better answers than i do

1261
00:44:26,630 --> 00:44:24,960
um i think this somewhat ties back to uh

1262
00:44:28,150 --> 00:44:26,640
the discussion that michael is timing in

1263
00:44:30,630 --> 00:44:28,160

on uh

1264
00:44:32,069 --> 00:44:30,640
about what the goal is here and it's

1265
00:44:33,270 --> 00:44:32,079
very you know there's a lot of questions

1266
00:44:35,030 --> 00:44:33,280
that we can ask that we're all

1267
00:44:36,390 --> 00:44:35,040
interested in answering but they some of

1268
00:44:37,270 --> 00:44:36,400
these questions in order to answer them

1269
00:44:40,710 --> 00:44:37,280
are

1270
00:44:43,030 --> 00:44:40,720
require a very long uh effort and so

1271
00:44:44,390 --> 00:44:43,040
part of as i understood it and uh i

1272
00:44:46,710 --> 00:44:44,400
thought twinkle doesn't get upset with

1273
00:44:48,150 --> 00:44:46,720
me by misunderstanding so as i

1274
00:44:50,550 --> 00:44:48,160
understood part of what we're trying to

1275
00:44:52,470 --> 00:44:50,560
do here is identify what are the big

1276
00:44:54,390 --> 00:44:52,480
kind of important questions to ask but

1277
00:44:56,309 --> 00:44:54,400
what are the achievable goals in the

1278
00:44:59,109 --> 00:44:56,319
next few years that this document is

1279
00:45:00,790 --> 00:44:59,119
meant to provide guidance and prioritize

1280
00:45:03,030 --> 00:45:00,800
in terms of the efforts that that will

1281
00:45:04,390 --> 00:45:03,040
be made so yes we want to

1282
00:45:05,829 --> 00:45:04,400
you know understand life on other

1283
00:45:07,270 --> 00:45:05,839
planets that's a great question our

1284
00:45:08,950 --> 00:45:07,280
great objective but we're not going to

1285
00:45:11,270 --> 00:45:08,960
be able to do that in the next

1286
00:45:13,030 --> 00:45:11,280
just couple years but what can we do to

1287
00:45:15,510 --> 00:45:13,040
start marching towards that to put us in

1288
00:45:17,670 --> 00:45:15,520

a place that we can answer that question

1289
00:45:19,109 --> 00:45:17,680
as we continue to build upon the science

1290
00:45:20,710 --> 00:45:19,119
that we're already doing in the science

1291
00:45:23,109 --> 00:45:20,720
network that is going to be done in the

1292
00:45:25,190 --> 00:45:23,119
next few years and so as i look at it

1293
00:45:26,950 --> 00:45:25,200
what we're trying to do is identify kind

1294
00:45:29,750 --> 00:45:26,960
of what the effort should what effort

1295
00:45:31,349 --> 00:45:29,760
should be made most immediately towards

1296
00:45:35,349 --> 00:45:31,359
you know answering some of the very

1297
00:45:40,230 --> 00:45:37,109
and i can see that sean is cross

1298
00:45:43,750 --> 00:45:40,240
trailing a future webinar building in

1299
00:45:48,950 --> 00:45:45,430
advertisements and self flood they're

1300
00:45:53,109 --> 00:45:50,230
other

1301
00:45:55,990 --> 00:45:53,119
questions or observations that would be

1302
00:45:59,349 --> 00:45:56,000
useful for the team are points you'd

1303
00:46:00,550 --> 00:45:59,359
like to to debate at this point

1304
00:46:03,510 --> 00:46:00,560
just while you're thinking about that

1305
00:46:06,309 --> 00:46:03,520
the the switch has now been flipped so

1306
00:46:08,309 --> 00:46:06,319
if it is more appropriate or more useful

1307
00:46:11,030 --> 00:46:08,319
for you to comment directly in the

1308
00:46:13,829 --> 00:46:11,040
document you can do that right now if

1309
00:46:16,230 --> 00:46:13,839
you had it open at the time you may need

1310
00:46:18,309 --> 00:46:16,240
to close it or you may need to refresh

1311
00:46:20,470 --> 00:46:18,319
your browser to get the changed status

1312
00:46:25,270 --> 00:46:20,480
on that but it is now

1313
00:46:25,280 --> 00:46:39,589

other thoughts

1314
00:46:43,190 --> 00:46:41,349
well just just to make a comment that i

1315
00:46:45,030 --> 00:46:43,200
think your choice of the major questions

1316
00:46:47,030 --> 00:46:45,040
you know seller properties chemistry

1317
00:46:49,190 --> 00:46:47,040
plan formation giant i think in a way

1318
00:46:52,390 --> 00:46:49,200
you've really captured what looks to me

1319
00:46:53,349 --> 00:46:52,400
like the waterfront uh for this so just

1320
00:46:55,109 --> 00:46:53,359
as a

1321
00:46:57,910 --> 00:46:55,119
vote from that column i just thought i'd

1322
00:47:00,309 --> 00:46:57,920
mention it i appreciate that um yeah and

1323
00:47:02,550 --> 00:47:00,319
i think in many ways though those broad

1324
00:47:05,750 --> 00:47:02,560
questions cast wide enough nets that

1325
00:47:07,430 --> 00:47:05,760
some of the sub questions we identify um

1326
00:47:09,750 --> 00:47:07,440
many of the sub questions that we

1327
00:47:13,829 --> 00:47:09,760
identified were able to fit pretty

1328
00:47:15,349 --> 00:47:13,839
easily into one of those categories um

1329
00:47:17,750 --> 00:47:15,359
but you know one of the things i think

1330
00:47:20,710 --> 00:47:17,760
is going to be most interesting is

1331
00:47:22,550 --> 00:47:20,720
uh many of us who were there were

1332
00:47:23,910 --> 00:47:22,560
as i said you can see who the people

1333
00:47:25,109 --> 00:47:23,920
were that put together this document

1334
00:47:26,309 --> 00:47:25,119
many of them were

1335
00:47:28,630 --> 00:47:26,319
largely

1336
00:47:29,990 --> 00:47:28,640
uh theory-centered people in their own

1337
00:47:32,069 --> 00:47:30,000
research and so i would be very

1338
00:47:33,910 --> 00:47:32,079

interested to get the

1339
00:47:35,829 --> 00:47:33,920
observers and i'm glad alicia's

1340
00:47:37,430 --> 00:47:35,839
commenting on this because she's

1341
00:47:41,109 --> 00:47:37,440
certainly one of the best musicians to

1342
00:47:42,950 --> 00:47:41,119
do so um but commenting on what uh from

1343
00:47:44,790 --> 00:47:42,960
the observational perspective what is

1344
00:47:46,150 --> 00:47:44,800
missing where some of the priorities

1345
00:47:47,510 --> 00:47:46,160
should be and some of the efforts should

1346
00:47:49,109 --> 00:47:47,520
be made um

1347
00:47:50,550 --> 00:47:49,119
because i know what i would like to see

1348
00:47:53,750 --> 00:47:50,560
medicine measured i don't know whether

1349
00:48:03,349 --> 00:47:53,760
it's possible or not so you know educate

1350
00:48:06,950 --> 00:48:05,349
i'll chime in fred thanks thanks for

1351
00:48:09,349 --> 00:48:06,960
leading this discussion i think the

1352
00:48:11,349 --> 00:48:09,359
document's really taken a nice shape i'm

1353
00:48:12,870 --> 00:48:11,359
hopeful that there will there will be a

1354
00:48:15,430 --> 00:48:12,880
lot of input from the community of

1355
00:48:17,510 --> 00:48:15,440
researchers who aren't expressly looking

1356
00:48:19,910 --> 00:48:17,520
at exoplanets as you as you mentioned

1357
00:48:21,510 --> 00:48:19,920
you know getting some some impressions

1358
00:48:23,589 --> 00:48:21,520
and some creative feedback from people

1359
00:48:25,349 --> 00:48:23,599
who study biology might be a really

1360
00:48:26,870 --> 00:48:25,359
great way to brainstorm what new

1361
00:48:28,630 --> 00:48:26,880
measurements could be made what's

1362
00:48:30,309 --> 00:48:28,640
missing from this document wondering

1363
00:48:37,030 --> 00:48:30,319

what's the what's the timeline for

1364
00:48:42,630 --> 00:48:39,109
that's a good question um we haven't

1365
00:48:43,430 --> 00:48:42,640
actually set an official cut off time i

1366
00:48:46,150 --> 00:48:43,440
think

1367
00:48:49,430 --> 00:48:46,160
the discussions that we had internally

1368
00:48:51,829 --> 00:48:49,440
is that um in the new year february

1369
00:48:53,589 --> 00:48:51,839
march time i'm anticipating that we

1370
00:48:54,870 --> 00:48:53,599
would have some sort of convergent

1371
00:48:57,750 --> 00:48:54,880
process

1372
00:49:02,470 --> 00:48:57,760
um michael do you want to is there any

1373
00:49:05,030 --> 00:49:02,480
more uh informed word on this subject

1374
00:49:06,710 --> 00:49:05,040
no not yet we probably need to start

1375
00:49:08,630 --> 00:49:06,720
working out the details of how we're

1376
00:49:09,430 --> 00:49:08,640
going to do the integration

1377
00:49:11,190 --> 00:49:09,440
but

1378
00:49:13,270 --> 00:49:11,200
certainly by

1379
00:49:17,109 --> 00:49:13,280
the march february march time frame we'd

1380
00:49:18,549 --> 00:49:17,119
like these documents to be as close to

1381
00:49:20,150 --> 00:49:18,559
um

1382
00:49:23,670 --> 00:49:20,160
i want to say done

1383
00:49:25,670 --> 00:49:23,680
but as close to paused as possible all

1384
00:49:27,270 --> 00:49:25,680
right

1385
00:49:29,349 --> 00:49:27,280
so uh

1386
00:49:31,510 --> 00:49:29,359
one one function of this document being

1387
00:49:33,750 --> 00:49:31,520
then in that time you know i'm saying

1388
00:49:35,270 --> 00:49:33,760

i'm at a meeting or even even at a party

1389
00:49:36,870 --> 00:49:35,280
uh and i get into a conversation that

1390
00:49:38,470 --> 00:49:36,880
touches on this document that i can give

1391
00:49:40,870 --> 00:49:38,480
someone to link and say hey go look at

1392
00:49:43,990 --> 00:49:40,880
this and feel free to leave a comment or

1393
00:49:49,510 --> 00:49:44,000
you know add something to it

1394
00:49:54,630 --> 00:49:52,150
uh yeah it's a great line for a party

1395
00:49:56,950 --> 00:49:54,640
come on comment on the document so um

1396
00:49:58,710 --> 00:49:56,960
yes all the documents uh as we as we

1397
00:50:00,309 --> 00:49:58,720
move through the webinar series all of

1398
00:50:02,870 --> 00:50:00,319
the documents will be opened up for

1399
00:50:05,589 --> 00:50:02,880
commenting and will then stay open for

1400
00:50:07,349 --> 00:50:05,599
commenting uh until

1401
00:50:10,790 --> 00:50:07,359
february march time when there's a sort

1402
00:50:13,030 --> 00:50:10,800
of convergent uh process on that um

1403
00:50:14,230 --> 00:50:13,040
probably just to add an interpretation

1404
00:50:16,630 --> 00:50:14,240
to that though

1405
00:50:19,270 --> 00:50:16,640
it would be helpful if you didn't see

1406
00:50:21,349 --> 00:50:19,280
the february march time as the deadline

1407
00:50:23,510 --> 00:50:21,359
and therefore that's the time you put in

1408
00:50:26,630 --> 00:50:23,520
your diary of oh i must have my comments

1409
00:50:28,150 --> 00:50:26,640
then sooner is more helpful than that um

1410
00:50:30,470 --> 00:50:28,160
so you could think of the deadline as

1411
00:50:32,309 --> 00:50:30,480
the end of next week um

1412
00:50:33,910 --> 00:50:32,319
and also because hopefully the comments

1413
00:50:35,829 --> 00:50:33,920

will simulate some discussion and

1414
00:50:37,510 --> 00:50:35,839
exchange not just you know being

1415
00:50:39,109 --> 00:50:37,520
something that we pack in every single

1416
00:50:40,790 --> 00:50:39,119
comment um

1417
00:50:43,030 --> 00:50:40,800
right

1418
00:50:45,030 --> 00:50:43,040
what what we have set up for some of the

1419
00:50:47,670 --> 00:50:45,040
earlier documents was we created a

1420
00:50:50,230 --> 00:50:47,680
discussion thread for each document on

1421
00:50:53,030 --> 00:50:50,240
the astro bio website

1422
00:50:54,790 --> 00:50:53,040
that hasn't been used and people have

1423
00:50:58,069 --> 00:50:54,800
tended to just put the comments straight

1424
00:50:59,829 --> 00:50:58,079
into the document however if it seems as

1425
00:51:02,230 --> 00:50:59,839
though that's helpful we can of course

1426
00:51:04,309 --> 00:51:02,240
always set up discussion threads for

1427
00:51:07,109 --> 00:51:04,319
specific documents if people want to

1428
00:51:09,910 --> 00:51:07,119
talk about things in a broader context

1429
00:51:12,549 --> 00:51:09,920
than just um making annotations to

1430
00:51:15,030 --> 00:51:12,559
individual uh sort of blocks of text

1431
00:51:17,030 --> 00:51:15,040
it's also we're more than happy to set

1432
00:51:19,670 --> 00:51:17,040
up additional um

1433
00:51:21,750 --> 00:51:19,680
topic-specific webinars if a group of

1434
00:51:24,230 --> 00:51:21,760
people say they want to to get together

1435
00:51:27,030 --> 00:51:24,240
and talk about that so the purpose of

1436
00:51:29,589 --> 00:51:27,040
these events is really just to um

1437
00:51:31,910 --> 00:51:29,599
show the papers to the to the wider

1438
00:51:34,230 --> 00:51:31,920

audience start soliciting comments and