



ABS*ci*CON 2017

MESA, ARIZONA

1
00:00:12,250 --> 00:00:06,150

you

2
00:00:16,900 --> 00:00:14,190

[Music]

3
00:00:20,019 --> 00:00:16,910

yeah part of this park was already given

4
00:00:23,410 --> 00:00:20,029

and so I imagined Lubar as being a giant

5
00:00:25,810 --> 00:00:23,420

telescope that we probably park at I2 so

6
00:00:29,109 --> 00:00:25,820

beyond the moon it lasts for a century

7
00:00:31,330 --> 00:00:29,119

right lasts for decades and it is a

8
00:00:34,689 --> 00:00:31,340

serviceable Oh John are you down to go

9
00:00:37,150 --> 00:00:34,699

to I2 and it takes a couple of weeks

10
00:00:40,030 --> 00:00:37,160

right or you can do a lot by robotic Lee

11
00:00:43,390 --> 00:00:40,040

but this is really a grand sort of

12
00:00:45,910 --> 00:00:43,400

vision I think it's also we should think

13
00:00:48,670 --> 00:00:45,920

of this not so much in isolation I would

14

00:00:51,490 --> 00:00:48,680

really love to see NASA develop the idea

15

00:00:53,650 --> 00:00:51,500

of an I2 Observatory where maybe NASA

16

00:00:55,930 --> 00:00:53,660

sets up the infrastructure and whatever

17

00:00:57,760 --> 00:00:55,940

we do for exoplanets is one of the

18

00:00:59,799 --> 00:00:57,770

missions I think the other studies far

19

00:01:01,959 --> 00:00:59,809

infrared and the high-energy emissions

20

00:01:04,869 --> 00:01:01,969

should be done as well but you can

21

00:01:09,520 --> 00:01:04,879

imagine then having China deliver an

22

00:01:11,710 --> 00:01:09,530

instrument or a or a toast go up to the

23

00:01:14,650 --> 00:01:11,720

I2 observatory right and we can partner

24

00:01:15,850 --> 00:01:14,660

that way to actually all do more so play

25

00:01:17,950 --> 00:01:15,860

a little bit about what we've been

26

00:01:19,840 --> 00:01:17,960

working on with revoir and the first

27

00:01:22,240 --> 00:01:19,850

thing I wanted to talk about is the name

28

00:01:24,640 --> 00:01:22,250

right so you already heard large

29

00:01:27,399 --> 00:01:24,650

ultraviolet optical infrared telescope

30

00:01:31,120 --> 00:01:27,409

and when a lot of people see this the

31

00:01:33,429 --> 00:01:31,130

name they pronounce it the wah okay like

32

00:01:37,030 --> 00:01:33,439

it's French all right you you pronounce

33

00:01:38,940 --> 00:01:37,040

it like a pirate the war okay so maybe

34

00:01:42,960 --> 00:01:38,950

we need to practice that is the war

35

00:01:45,280 --> 00:01:42,970

alright and so this is a space telescope

36

00:01:47,890 --> 00:01:45,290

in the tradition of Hubble that will

37

00:01:50,770 --> 00:01:47,900

last for a long time it has very broad

38

00:01:54,130 --> 00:01:50,780

science capabilities it extends from the

39

00:01:55,210 --> 00:01:54,140

far UV to the near IR band Paso's I'll

40

00:02:00,249 --> 00:01:55,220

show you a little bit more about that

41

00:02:03,100 --> 00:02:00,259

through the top and the wind paw hertz

42

00:02:04,780 --> 00:02:03,110

asked us to study this mission concept

43

00:02:08,560 --> 00:02:04,790

you know he said think about something

44

00:02:10,509 --> 00:02:08,570

in the range of 12 meter telescope or 15

45

00:02:13,030 --> 00:02:10,519

meter telescope but then I want you to

46

00:02:15,490 --> 00:02:13,040

tell me what we get scientifically if we

47

00:02:18,039 --> 00:02:15,500

put another ring of mirrors around this

48

00:02:21,130 --> 00:02:18,049

segmented telescope so it's truly a

49

00:02:23,619 --> 00:02:21,140

grand sort of vision we've been working

50

00:02:25,710 --> 00:02:23,629

on the types of instruments that we

51
00:02:28,890 --> 00:02:25,720
would have and where we think

52
00:02:31,440 --> 00:02:28,900
this as you heard all new missions that

53
00:02:34,110 --> 00:02:31,450
of this sort of scope have to be

54
00:02:36,150 --> 00:02:34,120
serviceable ok so we have to plan for

55
00:02:38,370 --> 00:02:36,160
that from the beginning that the

56
00:02:40,470 --> 00:02:38,380
instruments can be upgraded it would be

57
00:02:43,650 --> 00:02:40,480
the space observatory for the 21st

58
00:02:45,690 --> 00:02:43,660
century right an incredible way to

59
00:02:48,990 --> 00:02:45,700
answer questions that we haven't even

60
00:02:51,270 --> 00:02:49,000
began to ask yet and to sort of put this

61
00:02:53,970 --> 00:02:51,280
in context imagine astronomy today

62
00:02:55,950 --> 00:02:53,980
without Hubble right how different it

63
00:02:59,790 --> 00:02:55,960

would be without these sorts of pictures

64

00:03:03,180 --> 00:02:59,800

that we have and so that's what we're

65

00:03:05,880 --> 00:03:03,190

trying to imagine how astronomy will be

66

00:03:08,780 --> 00:03:05,890

changed when we go to Louvre are so here

67

00:03:11,790 --> 00:03:08,790

are some simulations you see a

68

00:03:14,070 --> 00:03:11,800

hypothetical planet 9 on the left-hand

69

00:03:16,740 --> 00:03:14,080

column are the actual observations that

70

00:03:20,610 --> 00:03:16,750

the pinwheel galaxy and then you see how

71

00:03:22,350 --> 00:03:20,620

these images would look with different

72

00:03:26,310 --> 00:03:22,360

telescopes which with the hubble space

73

00:03:28,400 --> 00:03:26,320

telescope with a small have x or

74

00:03:30,780 --> 00:03:28,410

lukewarm mission a 16 metre telescope

75

00:03:34,830 --> 00:03:30,790

and with something that's like you know

76
00:03:36,720 --> 00:03:34,840
at 16 18 meters in diameter so so size

77
00:03:39,270 --> 00:03:36,730
does matter

78
00:03:42,320 --> 00:03:39,280
you can learn this is a telescope that

79
00:03:44,970 --> 00:03:42,330
we envision will be for exoplanets

80
00:03:47,640 --> 00:03:44,980
astrobiology but will also serve the

81
00:03:49,770 --> 00:03:47,650
entire astronomical community will be

82
00:03:53,460 --> 00:03:49,780
able to study better how galaxies form

83
00:03:56,009 --> 00:03:53,470
and assemble their first stars so these

84
00:03:58,140 --> 00:03:56,019
rings show you in some sense the

85
00:04:01,770 --> 00:03:58,150
physical distance that we can go out

86
00:04:03,410 --> 00:04:01,780
into into the universe right the Hubble

87
00:04:06,840 --> 00:04:03,420
Space Telescope has given us these

88
00:04:10,890 --> 00:04:06,850

unbelievable pictures at the Deep Field

89

00:04:13,140 --> 00:04:10,900

and early galaxies JWST will be able to

90

00:04:15,060 --> 00:04:13,150

look a little bit further out and then

91

00:04:18,449 --> 00:04:15,070

depending on the size of the of a louvre

92

00:04:20,310 --> 00:04:18,459

our telescope 8 meters to 16 meters will

93

00:04:22,469 --> 00:04:20,320

make the difference between being able

94

00:04:24,990 --> 00:04:22,479

to actually see a large number of

95

00:04:28,469 --> 00:04:25,000

elliptical galaxies giant elliptical

96

00:04:32,610 --> 00:04:28,479

galaxies and understand those so leVoir

97

00:04:35,670 --> 00:04:32,620

will help us to reach out to 12 mega

98

00:04:37,950 --> 00:04:35,680

parsecs with incredible resolution we'll

99

00:04:40,650 --> 00:04:37,960

be able to actually resolve stars

100

00:04:43,499 --> 00:04:40,660

in the galaxies at these distances you

101
00:04:46,890 --> 00:04:43,509
already saw this one of these images in

102
00:04:49,529 --> 00:04:46,900
John's talk but the Europa Jets served

103
00:04:51,390 --> 00:04:49,539
with HST would have this kind of a

104
00:04:53,159 --> 00:04:51,400
resolution with leVoir so we're

105
00:04:56,279 --> 00:04:53,169
imagining that this is a Space Telescope

106
00:04:58,140 --> 00:04:56,289
that also serves the planetary science

107
00:05:02,219 --> 00:04:58,150
community people studying the solar

108
00:05:05,460 --> 00:05:02,229
system and then the killer app for the

109
00:05:08,659 --> 00:05:05,470
apps icon folks here is our ability to

110
00:05:12,300 --> 00:05:08,669
use a coronagraph and take images of

111
00:05:15,510 --> 00:05:12,310
Venus and Earth and Jupiter like planets

112
00:05:17,640 --> 00:05:15,520
orbiting stars this is an example a

113
00:05:20,640 --> 00:05:17,650

simulation of a solar system that's

114

00:05:23,610 --> 00:05:20,650

thirteen parsecs away and it has a

115

00:05:26,010 --> 00:05:23,620

coronagraph on a 12 meter telescope so

116

00:05:28,800 --> 00:05:26,020

it's the kind of resolution and images

117

00:05:31,320 --> 00:05:28,810

that you can expect to see we can then

118

00:05:33,560 --> 00:05:31,330

begin to take spectra of those dots if

119

00:05:36,839 --> 00:05:33,570

we can null out the light from the star

120

00:05:40,140 --> 00:05:36,849

the inner working angle is about 4

121

00:05:42,719 --> 00:05:40,150

λ over D allows us at 13 parsecs to

122

00:05:47,149 --> 00:05:42,729

be able to easily resolve Venus and

123

00:05:50,640 --> 00:05:47,159

certainly earth in a solar system analog

124

00:05:53,460 --> 00:05:50,650

so again the bio signatures are really

125

00:05:56,550 --> 00:05:53,470

what we're after right you can imagine

126
00:05:58,170 --> 00:05:56,560
looking for Rayleigh scattering but we

127
00:06:02,610 --> 00:05:58,180
also would like to be able to resolve

128
00:06:04,230 --> 00:06:02,620
oxygen see if there's water vapor see if

129
00:06:07,230 --> 00:06:04,240
there's methane coming out of the back

130
00:06:09,839 --> 00:06:07,240
ends or some cows on those planets and

131
00:06:13,200 --> 00:06:09,849
this means that we have to look from 0.4

132
00:06:15,689 --> 00:06:13,210
microns to 2.4 microns for the optical

133
00:06:19,800 --> 00:06:15,699
and near-infrared spectroscopy with the

134
00:06:23,010 --> 00:06:19,810
resolution of about 150 so a reality

135
00:06:26,279 --> 00:06:23,020
check is that this shows a spectrum of a

136
00:06:28,350 --> 00:06:26,289
modern earth and you see the wavelength

137
00:06:31,469 --> 00:06:28,360
range going again from point four to

138
00:06:33,930 --> 00:06:31,479

about two point five where the error

139

00:06:36,830 --> 00:06:33,940

bars get very large because the thermal

140

00:06:43,409 --> 00:06:36,840

background from the telescope is so high

141

00:06:45,540 --> 00:06:43,419

and if we looked at the Archaean earth

142

00:06:47,850 --> 00:06:45,550

so we heard about this this morning you

143

00:06:49,709 --> 00:06:47,860

know maybe we're looking at planets that

144

00:06:51,420 --> 00:06:49,719

are habitable worlds but they don't

145

00:06:54,360 --> 00:06:51,430

really quite look like ours

146

00:06:56,430 --> 00:06:54,370

you'd still be able to resolve whether

147

00:07:01,560 --> 00:06:56,440

or not there are these important oxygen

148

00:07:03,930 --> 00:07:01,570

or o3 signatures in the spectra so it

149

00:07:06,810 --> 00:07:03,940

allows us to have access to an

150

00:07:08,790 --> 00:07:06,820

incredible range of molecules and that

151
00:07:11,460 --> 00:07:08,800
helps us to understand the atmospheres

152
00:07:16,140 --> 00:07:11,470
we'll be able to see bands of oxygen

153
00:07:19,740 --> 00:07:16,150
ozone oh four hi h₂o carbon monoxide

154
00:07:22,560 --> 00:07:19,750
carbon dioxide and methane and the key

155
00:07:24,900 --> 00:07:22,570
is that will have multiple bands of the

156
00:07:26,730 --> 00:07:24,910
same molecules this isn't for anyone who

157
00:07:29,340 --> 00:07:26,740
does spectroscopy you understand how

158
00:07:33,360 --> 00:07:29,350
important this is to be able to have a

159
00:07:35,279 --> 00:07:33,370
secure abundance measurement the broad

160
00:07:37,860 --> 00:07:35,289
spectral band pass and the ultraviolet

161
00:07:40,980 --> 00:07:37,870
spectrum of the star can probably help

162
00:07:43,080 --> 00:07:40,990
us to rule out the false positive oxygen

163
00:07:45,589 --> 00:07:43,090

signatures bio signatures that we heard

164

00:07:49,409 --> 00:07:45,599

about at the end of the morning sessions

165

00:07:52,650 --> 00:07:49,419

and since the interworking angle with a

166

00:07:55,650 --> 00:07:52,660

large loop our telescope allows us to

167

00:07:58,290 --> 00:07:55,660

see planets like the earth at longer

168

00:08:00,570 --> 00:07:58,300

wavelengths will that will again give us

169

00:08:03,719 --> 00:08:00,580

more access to these incredible bio

170

00:08:05,909 --> 00:08:03,729

signatures we've done trade studies so

171

00:08:08,969 --> 00:08:05,919

there's another concept mission that's

172

00:08:11,969 --> 00:08:08,979

being studied have X and have X and

173

00:08:14,399 --> 00:08:11,979

lawar and some sense are a continuum of

174

00:08:17,219 --> 00:08:14,409

science both missions want to look at

175

00:08:20,640 --> 00:08:17,229

bio signatures both missions want to

176
00:08:22,529 --> 00:08:20,650
have some cosmic origin applications and

177
00:08:24,810 --> 00:08:22,539
it really comes down to a difference I

178
00:08:27,170 --> 00:08:24,820
think in the quantity of what we'll be

179
00:08:29,310 --> 00:08:27,180
able to measure so with a four meter

180
00:08:32,519 --> 00:08:29,320
telescope we'll hope to be able to

181
00:08:35,040 --> 00:08:32,529
detect something like six earth

182
00:08:37,350 --> 00:08:35,050
candidates when we increase the

183
00:08:40,589 --> 00:08:37,360
telescope size to eight meters the

184
00:08:42,570 --> 00:08:40,599
number goes up to about 25 and as we go

185
00:08:45,090 --> 00:08:42,580
up to a 16 meter telescope

186
00:08:47,970 --> 00:08:45,100
we're talking about being able to detect

187
00:08:51,600 --> 00:08:47,980
with a coronagraph chronographic imaging

188
00:08:53,970 --> 00:08:51,610

something like 100 earth candidates we

189

00:08:56,550 --> 00:08:53,980

think that isn't important because it's

190

00:08:59,220 --> 00:08:56,560

likely that not every one of these earth

191

00:09:02,040 --> 00:08:59,230

candidates will have spectral signatures

192

00:09:04,710 --> 00:09:02,050

bio signatures so if the frequency of

193

00:09:07,410 --> 00:09:04,720

habitable worlds is something like 10

194

00:09:10,590 --> 00:09:07,420

% then we'd like to have something like

195

00:09:13,530 --> 00:09:10,600

30 candidates right to be able to

196

00:09:18,269 --> 00:09:13,540

guarantee seeing one earth analog

197

00:09:20,429 --> 00:09:18,279

signature at with high confidence I

198

00:09:22,590 --> 00:09:20,439

think the most amazing thing is I

199

00:09:25,550 --> 00:09:22,600

remember in the early days of before

200

00:09:28,740 --> 00:09:25,560

Kepler was launched right and Kepler was

201
00:09:30,090 --> 00:09:28,750
going to measure a de sub earth and that

202
00:09:32,040 --> 00:09:30,100
was the most important thing and that

203
00:09:34,530 --> 00:09:32,050
was the that was the science goal that

204
00:09:37,230 --> 00:09:34,540
we were all focused on and what none of

205
00:09:38,999 --> 00:09:37,240
us really imagined or thought about was

206
00:09:42,269 --> 00:09:39,009
what Kepler would really discover this

207
00:09:44,100 --> 00:09:42,279
incredible zoo of exoplanets what a

208
00:09:45,780 --> 00:09:44,110
mission like would we have not funded

209
00:09:47,340 --> 00:09:45,790
Kepler if we would have known that a

210
00:09:49,170 --> 00:09:47,350
disturber was going to be this hard

211
00:09:52,319 --> 00:09:49,180
right and throwing away all of this

212
00:09:54,509 --> 00:09:52,329
incredible science so I think that's the

213
00:09:56,999 --> 00:09:54,519

kind of thing that we can expect from a

214

00:09:59,429 --> 00:09:57,009

large telescope that can collect spectra

215

00:10:02,220 --> 00:09:59,439

of exoplanet atmospheres we're going to

216

00:10:04,679 --> 00:10:02,230

learn so much about what these planets

217

00:10:07,980 --> 00:10:04,689

are like so there are some real

218

00:10:11,100 --> 00:10:07,990

observational challenges first of all to

219

00:10:13,079 --> 00:10:11,110

find faint planets sitting next to

220

00:10:15,540 --> 00:10:13,089

bright stars you have to use a

221

00:10:17,420 --> 00:10:15,550

coronagraph so the solution that we

222

00:10:20,429 --> 00:10:17,430

envision is an optical and near-infrared

223

00:10:22,259 --> 00:10:20,439

coronagraph with contrast ratios of 10

224

00:10:25,139 --> 00:10:22,269

to the minus 10 that allows you to

225

00:10:27,780 --> 00:10:25,149

actually begin to see an EXO

226

00:10:30,749 --> 00:10:27,790

we would have multi resolution

227

00:10:34,829 --> 00:10:30,759

spectroscopy so in a band pass over

228

00:10:36,540 --> 00:10:34,839

point 2 2 2 and 2.4 microns and this is

229

00:10:39,090 --> 00:10:36,550

technology development that's happening

230

00:10:41,879 --> 00:10:39,100

right now with w first for the w first

231

00:10:44,249 --> 00:10:41,889

coronagraph so a lawar mission is going

232

00:10:45,960 --> 00:10:44,259

to be able to draw on the experiences of

233

00:10:49,590 --> 00:10:45,970

the space missions that are being built

234

00:10:52,049 --> 00:10:49,600

right now another problem is the

235

00:10:54,540 --> 00:10:52,059

ultraviolet ultraviolet is so incredibly

236

00:10:56,759 --> 00:10:54,550

useful for understanding the atmosphere

237

00:10:58,319 --> 00:10:56,769

and the conditions of habitability we

238

00:11:00,990 --> 00:10:58,329

can't see the ultraviolet through the

239

00:11:03,059 --> 00:11:01,000

Earth's atmosphere so our plan is an

240

00:11:05,340 --> 00:11:03,069

instrument which we're called calling

241

00:11:07,829 --> 00:11:05,350

Loomis this is in the instrument design

242

00:11:10,590 --> 00:11:07,839

lab right now at Goddard Space Flight

243

00:11:12,900 --> 00:11:10,600

Center where we're trying to sort of go

244

00:11:15,360 --> 00:11:12,910

through the exercise of planning what

245

00:11:16,829 --> 00:11:15,370

this instrument would look like so in

246

00:11:18,170 --> 00:11:16,839

part so we can figure out the technical

247

00:11:21,829 --> 00:11:18,180

challenges and in Part 2

248

00:11:24,380 --> 00:11:21,839

we can cost develop a cost model for the

249

00:11:28,010 --> 00:11:24,390

instrument so this would the Lumos would

250

00:11:31,030 --> 00:11:28,020

do far UV to near UV spectroscopy the

251

00:11:35,090 --> 00:11:31,040

pi/4 this instrument is Kevin France

252

00:11:37,310 --> 00:11:35,100

would do near UV imaging and in essence

253

00:11:39,079 --> 00:11:37,320

it would be a major upgrade of stiffs on

254

00:11:41,810 --> 00:11:39,089

the Hubble Space Telescope for any of

255

00:11:44,630 --> 00:11:41,820

you who use that instrument another

256

00:11:47,329 --> 00:11:44,640

challenge is imaging very wide field at

257

00:11:50,240 --> 00:11:47,339

high resolution and so the solution to

258

00:11:52,400 --> 00:11:50,250

that is the high-definition imager Mark

259

00:11:56,090 --> 00:11:52,410

postman at Space Telescope is leading

260

00:11:58,519 --> 00:11:56,100

this instrument as a sort of pie the

261

00:12:01,040 --> 00:11:58,529

idea is to have a 2 by 3 arc minute

262

00:12:04,990 --> 00:12:01,050

field of view again it's an optical to

263

00:12:07,970 --> 00:12:05,000

infrared a bandpass and do incredible

264

00:12:10,670 --> 00:12:07,980

high-precision Strama tree so mike Chou

265

00:12:14,630 --> 00:12:10,680

has come up with an idea of using a

266

00:12:17,810 --> 00:12:14,640

couple of single mode fiber fed lasers

267

00:12:21,199 --> 00:12:17,820

to calibrate at the level of 10 to the

268

00:12:24,640 --> 00:12:21,209

minus fourth the pixel positions and to

269

00:12:27,410 --> 00:12:24,650

actually measure exoplanet masses

270

00:12:30,140 --> 00:12:27,420

another challenge is actually measuring

271

00:12:32,350 --> 00:12:30,150

the molecules so that here we envision

272

00:12:34,460 --> 00:12:32,360

an optical near infrared spectrograph

273

00:12:37,519 --> 00:12:34,470

Courteney dressing is going to be

274

00:12:39,860 --> 00:12:37,529

leading this study will have multiple

275

00:12:42,890 --> 00:12:39,870

resolutions nominally about a hundred

276

00:12:45,320 --> 00:12:42,900

thousand and this will allow us to have

277

00:12:48,350 --> 00:12:45,330

very high photometric precision for

278

00:12:49,790 --> 00:12:48,360

transit observations we're not sure

279

00:12:51,550 --> 00:12:49,800

we're about one of the other things we

280

00:12:54,230 --> 00:12:51,560

might do is is have the ability to

281

00:12:55,970 --> 00:12:54,240

measure high-precision radial velocities

282

00:12:58,400 --> 00:12:55,980

so that we can get masses of the

283

00:13:00,470 --> 00:12:58,410

exoplanets and coupled with the

284

00:13:04,640 --> 00:13:00,480

spectroscopic measurements we'll be able

285

00:13:07,160 --> 00:13:04,650

to interpret the data more reliably one

286

00:13:11,000 --> 00:13:07,170

of our European partners in France is

287

00:13:13,460 --> 00:13:11,010

building Pollock's a which is a UV

288

00:13:16,370 --> 00:13:13,470

spectra pool limiter polarimeter and it

289

00:13:18,410 --> 00:13:16,380

will work with the Lumos instrument and

290

00:13:20,660 --> 00:13:18,420

so and this is an example of a

291

00:13:22,760 --> 00:13:20,670

partnership with the international

292

00:13:25,670 --> 00:13:22,770

community all of you are encouraged to

293

00:13:27,560 --> 00:13:25,680

go to the Louvre our simulation page

294

00:13:29,690 --> 00:13:27,570

where you can see four different

295

00:13:31,910 --> 00:13:29,700

exposure times and different choices of

296

00:13:34,299 --> 00:13:31,920

aperture exactly what kind of

297

00:13:37,069 --> 00:13:34,309

you could get out of this these missions

298

00:13:40,129 --> 00:13:37,079

we're also encouraging you to come and

299

00:13:42,319 --> 00:13:40,139

give us some feedback right now there's

300

00:13:45,109 --> 00:13:42,329

a tech team that's examining the

301
00:13:47,660 --> 00:13:45,119
technological challenges to move our I'm

302
00:13:49,249 --> 00:13:47,670
one of them the deployment of levar will

303
00:13:54,829 --> 00:13:49,259
be tested by the James Webb Space

304
00:13:56,539 --> 00:13:54,839
Telescope there are other technical

305
00:13:57,999 --> 00:13:56,549
challenges first of all how do you we're

306
00:14:01,099 --> 00:13:58,009
going to need a heavy launch vehicle

307
00:14:03,650 --> 00:14:01,109
lift vehicle right with a large fairing

308
00:14:06,799 --> 00:14:03,660
to be able to get the segment's for a 16

309
00:14:09,829 --> 00:14:06,809
meter telescope into space we're working

310
00:14:11,900 --> 00:14:09,839
on compatibility of ultraviolet and UV

311
00:14:15,109 --> 00:14:11,910
the UV with choreography and high

312
00:14:16,999 --> 00:14:15,119
contrast observations and choreography

313
00:14:20,239 --> 00:14:17,009

with as segmented telescope

314

00:14:22,159 --> 00:14:20,249

these look like solvable solutions this

315

00:14:24,530 --> 00:14:22,169

is again one I'll go quickly through

316

00:14:26,119 --> 00:14:24,540

these slides one of just four mission

317

00:14:30,229 --> 00:14:26,129

concept studies that are being done

318

00:14:32,059 --> 00:14:30,239

right now there are two lawar mission

319

00:14:34,729 --> 00:14:32,069

architectures were studying we're

320

00:14:37,249 --> 00:14:34,739

imagining an aperture size of 15 meters

321

00:14:39,199 --> 00:14:37,259

on one of nine meters and these are set

322

00:14:40,609 --> 00:14:39,209

because they stopped because of the

323

00:14:43,729 --> 00:14:40,619

fairings that are available right now

324

00:14:47,090 --> 00:14:43,739

for launch vehicles the study office and

325

00:14:51,259 --> 00:14:47,100

engineering team is at Goddard and we've

326

00:14:53,780 --> 00:14:51,269

got a team of people's 24 of stdt

327

00:14:55,669 --> 00:14:53,790

members in the community and working

328

00:14:58,069 --> 00:14:55,679

groups studying all of these questions

329

00:15:02,119 --> 00:14:58,079

along with five instrument teams here

330

00:15:04,159 --> 00:15:02,129

are the pictures of the folks so often

331

00:15:05,389 --> 00:15:04,169

people ask so I'll anticipate some

332

00:15:07,850 --> 00:15:05,399

questions right now what is the

333

00:15:10,100 --> 00:15:07,860

difference between have X and lawar and

334

00:15:12,409 --> 00:15:10,110

we've worked together as a team to try

335

00:15:14,449 --> 00:15:12,419

and come up with an answer that we think

336

00:15:16,850 --> 00:15:14,459

will work that you know that we both

337

00:15:18,679 --> 00:15:16,860

agree upon first of all both of them

338

00:15:20,779 --> 00:15:18,689

have the science school of measuring

339

00:15:22,819 --> 00:15:20,789

habitable planets and bio signatures and

340

00:15:26,509 --> 00:15:22,829

both of them have the goal of doing

341

00:15:28,759 --> 00:15:26,519

broad astrophysics it's really more a

342

00:15:30,679 --> 00:15:28,769

matter of quantity how much you'll be

343

00:15:33,710 --> 00:15:30,689

able to do with the smaller telescope

344

00:15:35,869 --> 00:15:33,720

and the larger telescope so similar

345

00:15:38,799 --> 00:15:35,879

goals but different sort of quantitative

346

00:15:42,109 --> 00:15:38,809

levels of ambition for these two studies

347

00:15:43,999 --> 00:15:42,119

and then finally anticipating a question

348

00:15:45,350 --> 00:15:44,009

how much is it going to cost and the

349

00:15:46,699 --> 00:15:45,360

answer is we don't know

350

00:15:49,190 --> 00:15:46,709

that's why we're doing this study right

351

00:15:53,150 --> 00:15:49,200

now to try and get a sense of what this

352

00:15:55,160 --> 00:15:53,160

will cost so as John said it's not

353

00:15:57,550 --> 00:15:55,170

straightforward to estimate to our to

354

00:16:00,319 --> 00:15:57,560

extrapolate a cost for a large mission

355

00:16:02,090 --> 00:16:00,329

and then I'll put our summary slide up

356

00:16:04,670 --> 00:16:02,100

here that our primary goals are

357

00:16:07,370 --> 00:16:04,680

habitable exoplanets and bio signatures

358

00:16:10,030 --> 00:16:07,380

but also a large range of fundamental