



1  
00:00:11,030 --> 00:00:08,790  
if if only i was important enough to

2  
00:00:12,230 --> 00:00:11,040  
warrant that that's great thank you

3  
00:00:15,110 --> 00:00:12,240  
thank you

4  
00:00:17,510 --> 00:00:15,120  
well welcome to fame lab talking

5  
00:00:18,550 --> 00:00:17,520  
astrobiology with nasa thank you all for

6  
00:00:20,150 --> 00:00:18,560  
coming

7  
00:00:21,910 --> 00:00:20,160  
for those of you for the few people in

8  
00:00:25,990 --> 00:00:21,920  
the room that don't know who i am i'm dr

9  
00:00:27,509 --> 00:00:26,000  
mary wojtek what's my name uh voytech um

10  
00:00:29,349 --> 00:00:27,519  
and i didn't even get to have any of the

11  
00:00:31,269 --> 00:00:29,359  
refreshments

12  
00:00:33,590 --> 00:00:31,279  
i'm the head of the astrobiology program

13  
00:00:35,350 --> 00:00:33,600

at nasa astrobiology as you know is the

14

00:00:37,030 --> 00:00:35,360

study of the origin and evolution of

15

00:00:38,549 --> 00:00:37,040

life on this planet in order to

16

00:00:40,389 --> 00:00:38,559

understand where we might find it

17

00:00:42,549 --> 00:00:40,399

elsewhere in the universe

18

00:00:45,270 --> 00:00:42,559

now tonight you are going to see 11

19

00:00:48,630 --> 00:00:45,280

finalists that have competed

20

00:00:50,709 --> 00:00:48,640

with over 60 other scientists

21

00:00:52,869 --> 00:00:50,719

in a number of competitions held around

22

00:00:55,430 --> 00:00:52,879

the country one in houston one in denver

23

00:00:58,549 --> 00:00:55,440

washington dc and even a competition on

24

00:01:00,470 --> 00:00:58,559

online and these are the 11 finalists

25

00:01:02,869 --> 00:01:00,480

these talented scientists have drawn

26  
00:01:04,469 --> 00:01:02,879  
from their own experiences as well as

27  
00:01:06,710 --> 00:01:04,479  
some training that we provided to them

28  
00:01:08,070 --> 00:01:06,720  
as part of this competition and what are

29  
00:01:10,310 --> 00:01:08,080  
they going to do they're going to take

30  
00:01:11,670 --> 00:01:10,320  
three minutes only

31  
00:01:13,750 --> 00:01:11,680  
to describe a

32  
00:01:15,510 --> 00:01:13,760  
scientific concept in astrobiology

33  
00:01:16,950 --> 00:01:15,520  
planetary scientists or something more

34  
00:01:19,350 --> 00:01:16,960  
general

35  
00:01:21,109 --> 00:01:19,360  
uh without using any slides a task that

36  
00:01:23,429 --> 00:01:21,119  
is indeed difficult for any scientists

37  
00:01:25,109 --> 00:01:23,439  
i've ever met using only the props that

38  
00:01:26,789 --> 00:01:25,119

they can carry up onto the stage with

39

00:01:28,870 --> 00:01:26,799

them here

40

00:01:30,630 --> 00:01:28,880

what has brought us here tonight

41

00:01:32,390 --> 00:01:30,640

is nasa's commitment as well as the

42

00:01:33,510 --> 00:01:32,400

commitment of the scientists in this

43

00:01:34,390 --> 00:01:33,520

room

44

00:01:37,830 --> 00:01:34,400

to

45

00:01:41,109 --> 00:01:37,840

uh public enlightenment that is

46

00:01:43,030 --> 00:01:41,119

fostering science literacy communicating

47

00:01:45,590 --> 00:01:43,040

our science and our enthusiasm for the

48

00:01:47,350 --> 00:01:45,600

science that we do because we cr we

49

00:01:49,350 --> 00:01:47,360

appreciate the support of the american

50

00:01:51,990 --> 00:01:49,360

public as well as the resources we get

51  
00:01:54,630 --> 00:01:52,000  
from the american taxpayer

52  
00:01:56,709 --> 00:01:54,640  
no one understood this better and and

53  
00:01:57,830 --> 00:01:56,719  
rose to the challenge as well as carl

54  
00:01:59,670 --> 00:01:57,840  
sagan

55  
00:02:02,230 --> 00:01:59,680  
some consider him the greatest science

56  
00:02:05,190 --> 00:02:02,240  
communicator in the 20th century

57  
00:02:06,310 --> 00:02:05,200  
he left a legacy that inspired many

58  
00:02:08,469 --> 00:02:06,320  
uh a

59  
00:02:10,070 --> 00:02:08,479  
youth and individual to go on into

60  
00:02:11,750 --> 00:02:10,080  
science careers

61  
00:02:13,510 --> 00:02:11,760  
and i had the opportunity to share with

62  
00:02:14,630 --> 00:02:13,520  
you this evening a recording from his

63  
00:02:16,390 --> 00:02:14,640

sister

64

00:02:18,869 --> 00:02:16,400

carrie sagan green

65

00:02:21,350 --> 00:02:18,879

who we were delighted to see joined us

66

00:02:23,670 --> 00:02:21,360

in houston for our competition

67

00:02:25,589 --> 00:02:23,680

and asked to address our contestants so

68

00:02:29,110 --> 00:02:25,599

we have a recorded message message from

69

00:02:31,509 --> 00:02:29,120

her that you'll hear now thank you hello

70

00:02:33,750 --> 00:02:31,519

i am delighted that you are here looking

71

00:02:36,390 --> 00:02:33,760

forward to hearing the contestants

72

00:02:39,990 --> 00:02:36,400

participating in the u.s science

73

00:02:42,390 --> 00:02:40,000

communication competition finals

74

00:02:44,309 --> 00:02:42,400

the need to explore sits deep within the

75

00:02:46,790 --> 00:02:44,319

human psyche

76

00:02:47,990 --> 00:02:46,800

men and women exploring space is

77

00:02:49,910 --> 00:02:48,000

expensive

78

00:02:52,390 --> 00:02:49,920

but the technological benefits and

79

00:02:55,030 --> 00:02:52,400

practical advances for us who are

80

00:02:56,550 --> 00:02:55,040

earthbound would be many as we have

81

00:02:59,430 --> 00:02:56,560

already seen

82

00:03:02,630 --> 00:02:59,440

and sharing costs with other nations is

83

00:03:05,670 --> 00:03:02,640

certainly going in the right direction

84

00:03:08,869 --> 00:03:05,680

recently stephen hawking celebrated his

85

00:03:11,110 --> 00:03:08,879

70th birthday and commented

86

00:03:14,309 --> 00:03:11,120

i don't think we will survive another

87

00:03:16,869 --> 00:03:14,319

thousand years without escaping beyond

88

00:03:18,869 --> 00:03:16,879

our fragile planet

89

00:03:20,869 --> 00:03:18,879

i'd like to give you two quotes from my

90

00:03:23,270 --> 00:03:20,879

brother carl sagan

91

00:03:25,830 --> 00:03:23,280

the first one i have as a bumper sticker

92

00:03:28,390 --> 00:03:25,840

on my car

93

00:03:31,110 --> 00:03:28,400

it is far better to grasp the universe

94

00:03:33,910 --> 00:03:31,120

as it really is than to persist in

95

00:03:36,390 --> 00:03:33,920

delusion however satisfying and

96

00:03:39,830 --> 00:03:36,400

reassuring

97

00:03:42,869 --> 00:03:39,840

so i implore you to do sound science and

98

00:03:45,990 --> 00:03:42,879

not be afraid to give up pet theories if

99

00:03:48,949 --> 00:03:46,000

the evidence is elsewhere

100

00:03:51,910 --> 00:03:48,959

my second quote from carl is this

101  
00:03:54,789 --> 00:03:51,920  
if we manage to avoid self-destruction

102  
00:03:57,589 --> 00:03:54,799  
so that there are future historians our

103  
00:03:59,910 --> 00:03:57,599  
time will be remembered in part because

104  
00:04:01,350 --> 00:03:59,920  
this was when we first set sail for

105  
00:04:02,789 --> 00:04:01,360  
other worlds

106  
00:04:05,509 --> 00:04:02,799  
in the long run

107  
00:04:08,149 --> 00:04:05,519  
as we straighten things out down here

108  
00:04:10,869 --> 00:04:08,159  
there will be more of us up there

109  
00:04:13,589 --> 00:04:10,879  
there will be robot emissaries and human

110  
00:04:18,229 --> 00:04:13,599  
outposts throughout the solar system

111  
00:04:20,469 --> 00:04:18,239  
we will become a multi-planet species

112  
00:04:22,469 --> 00:04:20,479  
i believe that eventually we will be

113  
00:04:24,469 --> 00:04:22,479

well off planet

114

00:04:27,510 --> 00:04:24,479

now is the time to increase this

115

00:04:29,590 --> 00:04:27,520

investment in our species future

116

00:04:30,710 --> 00:04:29,600

regardless if you win this competition

117

00:04:33,030 --> 00:04:30,720

or not

118

00:04:35,430 --> 00:04:33,040

always be advocates for science in

119

00:04:38,390 --> 00:04:35,440

general and space exploration in

120

00:04:41,110 --> 00:04:38,400

particular and clearly communicate your

121

00:04:52,950 --> 00:04:41,120

passion to people everywhere

122

00:04:56,310 --> 00:04:54,710

so now i would like to acknowledge our

123

00:04:57,830 --> 00:04:56,320

partners the cheltenham science

124

00:04:59,670 --> 00:04:57,840

festivals and

125

00:05:01,110 --> 00:04:59,680

the blue marble space institute for

126  
00:05:03,510 --> 00:05:01,120  
science and i'd like to take the

127  
00:05:04,469 --> 00:05:03,520  
opportunity to introduce two individuals

128  
00:05:06,310 --> 00:05:04,479  
to you

129  
00:05:08,230 --> 00:05:06,320  
for which if they had not helped me out

130  
00:05:09,510 --> 00:05:08,240  
with this idea this would have never

131  
00:05:11,590 --> 00:05:09,520  
happened

132  
00:05:26,629 --> 00:05:11,600  
shawn domigal goldman

133  
00:05:30,230 --> 00:05:28,790  
i i just want to take a moment here to

134  
00:05:31,830 --> 00:05:30,240  
talk about the community of

135  
00:05:33,270 --> 00:05:31,840  
communicators that we've been building

136  
00:05:34,390 --> 00:05:33,280  
through the family of astrobiology

137  
00:05:37,830 --> 00:05:34,400  
events

138  
00:05:39,430 --> 00:05:37,840

this is absycon a scientific conference

139

00:05:41,350 --> 00:05:39,440

is public communications events so

140

00:05:42,950 --> 00:05:41,360

there's a lot of big brains in the room

141

00:05:44,310 --> 00:05:42,960

but the contestants not just the

142

00:05:45,670 --> 00:05:44,320

finalists you'll see here today but

143

00:05:47,590 --> 00:05:45,680

people that have been participating

144

00:05:49,110 --> 00:05:47,600

throughout all our preliminaries

145

00:05:50,950 --> 00:05:49,120

they've done something very brave

146

00:05:52,629 --> 00:05:50,960

they've gotten up on stage and shared

147

00:05:54,469 --> 00:05:52,639

their life's work with the public and

148

00:05:56,309 --> 00:05:54,479

that takes guts and they've done so

149

00:05:57,990 --> 00:05:56,319

effectively they've identified with

150

00:06:00,070 --> 00:05:58,000

other human beings with different

151  
00:06:01,510 --> 00:06:00,080  
backgrounds and levels of experience and

152  
00:06:03,749 --> 00:06:01,520  
the capability to do that also takes

153  
00:06:05,350 --> 00:06:03,759  
heart and i don't speak for just myself

154  
00:06:06,629 --> 00:06:05,360  
or even just mary and danielle when i

155  
00:06:09,110 --> 00:06:06,639  
say that the people that have seen you

156  
00:06:12,150 --> 00:06:09,120  
do that have been inspired by the

157  
00:06:13,510 --> 00:06:12,160  
wonderment and the sense of of of being

158  
00:06:14,790 --> 00:06:13,520  
that we get when looking at the universe

159  
00:06:16,629 --> 00:06:14,800  
and studying it

160  
00:06:18,070 --> 00:06:16,639  
and on a personal level and your

161  
00:06:20,469 --> 00:06:18,080  
attempts to be like one of our mutual

162  
00:06:21,990 --> 00:06:20,479  
idols carl sagan you've made me feel

163  
00:06:23,830 --> 00:06:22,000

like another mutual idol of ours and

164

00:06:25,110 --> 00:06:23,840

that's kermit the frog

165

00:06:27,189 --> 00:06:25,120

because

166

00:06:29,189 --> 00:06:27,199

we we we got this stage you procured a

167

00:06:31,430 --> 00:06:29,199

stage and i twisted some of your arms

168

00:06:33,430 --> 00:06:31,440

and dragged you up onto it but then we

169

00:06:35,430 --> 00:06:33,440

got to sit down and we got to watch you

170

00:06:37,830 --> 00:06:35,440

own the stage and that was very special

171

00:06:39,510 --> 00:06:37,840

to us so i want you all to stand the 11

172

00:06:40,950 --> 00:06:39,520

finalists but also all of the people

173

00:06:43,350 --> 00:06:40,960

that have participated in any of our

174

00:06:58,870 --> 00:06:43,360

denver stand up come on stand up stand

175

00:07:03,990 --> 00:07:00,830

thank you all i really mean

176

00:07:05,909 --> 00:07:04,000

it all right thank you sean all right

177

00:07:08,950 --> 00:07:05,919

now as i think everyone in this room

178

00:07:11,749 --> 00:07:08,960

knows the nasa astrobiology program has

179

00:07:13,189 --> 00:07:11,759

always valued and always prioritized

180

00:07:15,350 --> 00:07:13,199

training the next generation of

181

00:07:17,350 --> 00:07:15,360

astrobiologists

182

00:07:19,029 --> 00:07:17,360

mary and sean and i have spent a lot of

183

00:07:21,270 --> 00:07:19,039

quality time with some of those young

184

00:07:22,150 --> 00:07:21,280

scientists over the last few months

185

00:07:23,589 --> 00:07:22,160

and

186

00:07:26,469 --> 00:07:23,599

we're here to tell you that that

187

00:07:28,469 --> 00:07:26,479

investment has paid off

188

00:07:31,189 --> 00:07:28,479

we'd like to take this opportunity to

189

00:07:34,230 --> 00:07:31,199

say thank you to the senior scientists

190

00:07:38,070 --> 00:07:34,240

advisors and mentors in the room

191

00:07:39,990 --> 00:07:38,080

your commitment to them is evident

192

00:07:42,390 --> 00:07:40,000

as you'll see in a moment the support

193

00:07:47,270 --> 00:07:42,400

and guidance you give them every day day

194

00:07:52,469 --> 00:07:50,230

is reflected in their incredible talent

195

00:07:54,230 --> 00:07:52,479

their boundless energy

196

00:07:56,150 --> 00:07:54,240

and their unwavering commitment to

197

00:07:58,790 --> 00:07:56,160

astrobiology

198

00:08:08,230 --> 00:07:58,800

so thank you again and keep up the good

199

00:08:12,309 --> 00:08:10,629

okay we're going to get started without

200

00:08:14,390 --> 00:08:12,319

further ado i'm just going to take one

201  
00:08:17,670 --> 00:08:14,400  
moment now to remind everyone go ahead

202  
00:08:19,430 --> 00:08:17,680  
and silence your cell phones please

203  
00:08:20,629 --> 00:08:19,440  
okay i'm going to begin by introducing

204  
00:08:22,469 --> 00:08:20,639  
the judges

205  
00:08:24,390 --> 00:08:22,479  
they have made a huge contribution to

206  
00:08:25,670 --> 00:08:24,400  
this effort over the last few months and

207  
00:08:27,670 --> 00:08:25,680  
we're thrilled to have you here again

208  
00:08:29,749 --> 00:08:27,680  
with us so

209  
00:08:31,830 --> 00:08:29,759  
david grinspoon

210  
00:08:33,670 --> 00:08:31,840  
is curator of astrobiology at the denver

211  
00:08:36,149 --> 00:08:33,680  
museum of nature and science and adjunct

212  
00:08:38,389 --> 00:08:36,159  
professor of astrophysical and planetary

213  
00:08:41,029 --> 00:08:38,399

science at the university of colorado

214

00:08:44,070 --> 00:08:41,039

as you know he will soon occupy the

215

00:08:45,670 --> 00:08:44,080

newly established baruch s blumberg nasa

216

00:08:47,750 --> 00:08:45,680

library of congress chair and

217

00:08:50,070 --> 00:08:47,760

astrobiology

218

00:08:51,910 --> 00:08:50,080

david was awarded the 2006 carl sagan

219

00:08:53,829 --> 00:08:51,920

medal for public communication of

220

00:08:55,430 --> 00:08:53,839

planetary science by the american

221

00:09:07,110 --> 00:08:55,440

astronomical society please welcome

222

00:09:11,750 --> 00:09:09,509

all right linda billings

223

00:09:13,350 --> 00:09:11,760

linda billings is a research professor

224

00:09:14,949 --> 00:09:13,360

at the george washington university

225

00:09:16,710 --> 00:09:14,959

school of media and public affairs in

226

00:09:18,470 --> 00:09:16,720

washington d.c

227

00:09:21,030 --> 00:09:18,480

she does communication research for

228

00:09:23,350 --> 00:09:21,040

nasa's astrobiology program in science

229

00:09:25,269 --> 00:09:23,360

mission directorate

230

00:09:27,030 --> 00:09:25,279

she has advised nasa's lead scientist

231

00:09:28,710 --> 00:09:27,040

for mars exploration and nasa's

232

00:09:30,310 --> 00:09:28,720

planetary protection officer on

233

00:09:32,310 --> 00:09:30,320

communications

234

00:09:33,750 --> 00:09:32,320

her research focused on the focuses on

235

00:09:35,990 --> 00:09:33,760

the rhetoric of science and space

236

00:09:38,230 --> 00:09:36,000

exploration and the social construction

237

00:09:49,590 --> 00:09:38,240

of scientific authority

238

00:09:53,590 --> 00:09:52,230

bill margle has worked for the last 23

239

00:09:55,269 --> 00:09:53,600  
years in many positions in the

240

00:09:58,150 --> 00:09:55,279  
television industry

241

00:09:59,190 --> 00:09:58,160  
as writer producer editor developer and

242

00:10:01,269 --> 00:09:59,200  
executive

243

00:10:02,470 --> 00:10:01,279  
bill has worked at the sci-fi channel

244

00:10:05,670 --> 00:10:02,480  
tnt

245

00:10:08,710 --> 00:10:05,680  
the travel channel and discovery studios

246

00:10:10,150 --> 00:10:08,720  
in 2008 bill joined national geographic

247

00:10:12,470 --> 00:10:10,160  
and is currently vice president of

248

00:10:14,630 --> 00:10:12,480  
national geographic television

249

00:10:16,069 --> 00:10:14,640  
bill has a love of science and adventure

250

00:10:18,069 --> 00:10:16,079  
and in spite of the fact that he would

251  
00:10:20,470 --> 00:10:18,079  
most certainly lose his lunch and his in

252  
00:10:30,870 --> 00:10:20,480  
his helmet still dreams of being an

253  
00:10:34,790 --> 00:10:32,870  
and i think the moment many of you have

254  
00:10:37,509 --> 00:10:34,800  
been waiting for

255  
00:10:39,750 --> 00:10:37,519  
we have invited a very special guest to

256  
00:10:41,910 --> 00:10:39,760  
host tonight's event

257  
00:10:44,550 --> 00:10:41,920  
it seems only appropriate that the chief

258  
00:10:46,949 --> 00:10:44,560  
communications officer of the starship

259  
00:10:49,350 --> 00:10:46,959  
enterprise should be part of the

260  
00:11:02,069 --> 00:10:49,360  
inaugural fame lab astrobiology

261  
00:11:05,829 --> 00:11:03,990  
so here tonight with us is ms michelle

262  
00:11:09,350 --> 00:11:05,839  
nichols

263  
00:11:12,630 --> 00:11:09,360

roddenberry to create chief

264

00:11:14,069 --> 00:11:12,640

communications officer lieutenant uhura

265

00:11:16,710 --> 00:11:14,079

fourth in command of the starship

266

00:11:17,990 --> 00:11:16,720

enterprise in his legendary tv series

267

00:11:20,150 --> 00:11:18,000

star trek

268

00:11:23,269 --> 00:11:20,160

in the words of dr martin luther king it

269

00:11:25,190 --> 00:11:23,279

became quote the first non-stereotypical

270

00:11:27,509 --> 00:11:25,200

role portrayed by a black woman in

271

00:11:29,910 --> 00:11:27,519

television history

272

00:11:31,990 --> 00:11:29,920

in 1992 she became the first

273

00:11:34,630 --> 00:11:32,000

african-american to place her handprints

274

00:11:36,870 --> 00:11:34,640

and signature in the cement walk at the

275

00:11:39,350 --> 00:11:36,880

famous man's chinese theater along with

276

00:11:41,110 --> 00:11:39,360

her other command crew members of the

277

00:11:42,790 --> 00:11:41,120

starship enterprise

278

00:11:44,790 --> 00:11:42,800

they were also honored in a special

279

00:11:47,269 --> 00:11:44,800

exhibit at the smithsonian's national

280

00:11:49,430 --> 00:11:47,279

air and space museum in washington dc

281

00:11:52,870 --> 00:11:49,440

an unprecedented accolade for the

282

00:11:56,870 --> 00:11:54,629

ms nichols public service activities

283

00:11:59,110 --> 00:11:56,880

have been equally outstanding

284

00:12:01,190 --> 00:11:59,120

working with nasa in the late 70s she

285

00:12:02,790 --> 00:12:01,200

successfully recruited the first women

286

00:12:04,710 --> 00:12:02,800

and minority astronauts for the space

287

00:12:06,550 --> 00:12:04,720

shuttle program for which she received

288

00:12:08,069 --> 00:12:06,560

nasa's distinguished published public

289

00:12:09,829 --> 00:12:08,079

service award

290

00:12:12,790 --> 00:12:09,839

she continues to be a close friend and

291

00:12:14,870 --> 00:12:12,800

staunch supporter of dr mae jemison who

292

00:12:17,269 --> 00:12:14,880

first saw lieutenant uhura when she was

293

00:12:18,790 --> 00:12:17,279

nine years old and was determined to

294

00:12:20,629 --> 00:12:18,800

follow her dream to become the first

295

00:12:22,470 --> 00:12:20,639

woman of color astronaut

296

00:12:25,190 --> 00:12:22,480

which she did

297

00:12:36,629 --> 00:12:25,200

please join me in welcoming ms michelle

298

00:12:36,639 --> 00:13:02,069

thank you thank you

299

00:13:09,190 --> 00:13:04,150

i thank you

300

00:13:10,790 --> 00:13:09,200

daniela thank you mary

301  
00:13:13,350 --> 00:13:10,800  
and

302  
00:13:15,350 --> 00:13:13,360  
this whole organization

303  
00:13:16,710 --> 00:13:15,360  
and

304  
00:13:18,230 --> 00:13:16,720  
i thank

305  
00:13:20,389 --> 00:13:18,240  
the blessing

306  
00:13:21,670 --> 00:13:20,399  
that um

307  
00:13:25,030 --> 00:13:21,680  
brings out

308  
00:13:27,350 --> 00:13:25,040  
so many people who believe

309  
00:13:30,949 --> 00:13:29,110  
where we're going

310  
00:13:33,350 --> 00:13:30,959  
where we've been

311  
00:13:35,030 --> 00:13:33,360  
and where how we're going to get

312  
00:13:37,509 --> 00:13:35,040  
to the next step

313  
00:13:38,470 --> 00:13:37,519

doesn't make any difference we're gonna

314

00:13:40,230 --> 00:13:38,480

go

315

00:13:45,670 --> 00:13:40,240

we're

316

00:13:46,550 --> 00:13:45,680

whatever it takes

317

00:13:49,750 --> 00:13:46,560

young

318

00:13:55,750 --> 00:13:49,760

men and women who are

319

00:13:59,750 --> 00:13:58,710

you give me shivers

320

00:14:01,910 --> 00:13:59,760

so

321

00:14:07,030 --> 00:14:01,920

any mistakes that i make up here your

322

00:14:11,189 --> 00:14:09,590

i think you're the luckiest people on

323

00:14:13,590 --> 00:14:11,199

the planet

324

00:14:15,509 --> 00:14:13,600

including those who

325

00:14:16,949 --> 00:14:15,519

stood who

326

00:14:20,550 --> 00:14:16,959

are not part of

327

00:14:22,629 --> 00:14:20,560

are not you are part and parcel of this

328

00:14:24,310 --> 00:14:22,639

wonderful event tonight

329

00:14:26,790 --> 00:14:24,320

um

330

00:14:29,750 --> 00:14:26,800

it gives me great pleasure to have been

331

00:14:34,230 --> 00:14:31,189

to

332

00:14:35,990 --> 00:14:34,240

be part of this

333

00:14:38,389 --> 00:14:36,000

and i don't know what i'm doing either

334

00:14:42,629 --> 00:14:38,399

so whatever happens

335

00:14:45,509 --> 00:14:42,639

pretend that i know what i'm doing

336

00:14:47,590 --> 00:14:45,519

i was so honored when nasa asked me

337

00:14:48,629 --> 00:14:47,600

uh to partake

338

00:14:50,310 --> 00:14:48,639

and

339

00:14:51,990 --> 00:14:50,320

now that i'm here

340

00:14:53,829 --> 00:14:52,000

and see you all

341

00:14:55,910 --> 00:14:53,839

i truly know

342

00:14:56,949 --> 00:14:55,920

how important

343

00:14:58,470 --> 00:14:56,959

um

344

00:15:00,550 --> 00:14:58,480

what you're doing

345

00:15:02,790 --> 00:15:00,560

what you're giving

346

00:15:04,230 --> 00:15:02,800

what you're receiving

347

00:15:06,389 --> 00:15:04,240

and

348

00:15:08,949 --> 00:15:06,399

what will make this world

349

00:15:11,350 --> 00:15:08,959

a better place each and every one of you

350

00:15:13,110 --> 00:15:11,360

have a hand in this

351  
00:15:18,069 --> 00:15:13,120  
and

352  
00:15:19,350 --> 00:15:18,079  
get to my business thank you judges for

353  
00:15:20,310 --> 00:15:19,360  
joining us

354  
00:15:23,269 --> 00:15:20,320  
our

355  
00:15:27,829 --> 00:15:24,550  
auspicious

356  
00:15:39,430 --> 00:15:27,839  
panel of judges

357  
00:15:45,430 --> 00:15:42,870  
contestants good luck and um you have my

358  
00:15:47,430 --> 00:15:45,440  
blessings each and every one of you

359  
00:15:48,790 --> 00:15:47,440  
you each deserve it

360  
00:15:51,269 --> 00:15:48,800  
thank you

361  
00:15:54,470 --> 00:15:51,279  
our first contestant

362  
00:15:56,470 --> 00:15:54,480  
here at fam lab astrobiology

363  
00:15:58,470 --> 00:15:56,480

our first contestant is michael

364

00:16:01,189 --> 00:15:58,480

chieftain

365

00:16:10,870 --> 00:16:03,590

chafton

366

00:16:10,880 --> 00:16:13,829

and um

367

00:16:13,839 --> 00:16:17,590

even though i lived in the

368

00:16:17,600 --> 00:16:20,949

23rd century

369

00:16:27,430 --> 00:16:24,870

um i beam back here now which means

370

00:16:31,110 --> 00:16:27,440

that the perfection that it that mankind

371

00:16:33,509 --> 00:16:31,120

achieved in the 23rd century has not

372

00:16:38,470 --> 00:16:33,519

quite caught up in this century so i'm

373

00:16:42,550 --> 00:16:40,310

our first contestant

374

00:16:43,749 --> 00:16:42,560

is michael chapton

375

00:16:46,470 --> 00:16:43,759

chatham

376

00:16:46,480 --> 00:16:52,870

jeez

377

00:17:00,150 --> 00:16:55,430

chef chief chad

378

00:17:04,949 --> 00:17:02,790

he's a planetary scientist

379

00:17:07,189 --> 00:17:04,959

he will be addressing the following

380

00:17:08,949 --> 00:17:07,199

question

381

00:17:14,069 --> 00:17:08,959

where did how did they get her up on the

382

00:17:14,079 --> 00:17:29,510

does science require

383

00:17:32,470 --> 00:17:30,789

are you ready

384

00:17:34,150 --> 00:17:32,480

we're going to resolve all conflicts

385

00:17:35,430 --> 00:17:34,160

between science and faith in under three

386

00:17:37,110 --> 00:17:35,440

minutes

387

00:17:39,190 --> 00:17:37,120

and i'm going to help by telling you a

388

00:17:40,950 --> 00:17:39,200

story about the stars

389

00:17:43,350 --> 00:17:40,960

stars rise in the east and set in the

390

00:17:45,430 --> 00:17:43,360

west passing overhead every night but

391

00:17:46,710 --> 00:17:45,440

one star doesn't move

392

00:17:48,230 --> 00:17:46,720

polaris

393

00:17:49,750 --> 00:17:48,240

the north star

394

00:17:51,110 --> 00:17:49,760

we call it polaris because it's above

395

00:17:52,470 --> 00:17:51,120

the earth's pole

396

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

and if you can imagine spinning a

397

00:17:55,909 --> 00:17:54,480

basketball in the tip of your finger

398

00:17:58,950 --> 00:17:55,919

it's on one of those two points on the

399

00:18:00,230 --> 00:17:58,960

basketball that doesn't move as it spins

400

00:18:02,549 --> 00:18:00,240

it doesn't move in the sky and that's

401  
00:18:05,350 --> 00:18:02,559  
why it's so useful for navigation

402  
00:18:07,590 --> 00:18:05,360  
but polaris wasn't always the north star

403  
00:18:10,230 --> 00:18:07,600  
the earth spins like a top and like a

404  
00:18:12,230 --> 00:18:10,240  
top spinning down it wobbles

405  
00:18:14,549 --> 00:18:12,240  
the wobble is so slow

406  
00:18:16,630 --> 00:18:14,559  
so slow that it takes 26 000 years for

407  
00:18:18,230 --> 00:18:16,640  
the earth to wobble once

408  
00:18:19,430 --> 00:18:18,240  
that's slow enough that when we point to

409  
00:18:20,950 --> 00:18:19,440  
polaris

410  
00:18:24,150 --> 00:18:20,960  
we're pointing to the same north star

411  
00:18:28,710 --> 00:18:26,150  
so this wobble which scientists call

412  
00:18:30,150 --> 00:18:28,720  
precession is slow it's hard to detect

413  
00:18:32,310 --> 00:18:30,160

so maybe you're saying we've only known

414

00:18:33,270 --> 00:18:32,320

about it for 50 years maybe a hundred

415

00:18:34,870 --> 00:18:33,280

tops

416

00:18:37,430 --> 00:18:34,880

but i'm here to tell you that we've

417

00:18:38,950 --> 00:18:37,440

known about it since antiquity

418

00:18:40,870 --> 00:18:38,960

two thousand years ago a man named

419

00:18:43,190 --> 00:18:40,880

heparcus was an astronomer on the isle

420

00:18:44,710 --> 00:18:43,200

of rhodes in the mediterranean sea

421

00:18:47,350 --> 00:18:44,720

he was the first astronomer to make a

422

00:18:48,870 --> 00:18:47,360

comprehensive chart of the stars

423

00:18:51,510 --> 00:18:48,880

he would look at a star in the heavens

424

00:18:53,110 --> 00:18:51,520

and mark it down on his chart

425

00:18:55,029 --> 00:18:53,120

and while he was making his charts he

426

00:18:56,710 --> 00:18:55,039

came across an earlier chart

427

00:18:58,870 --> 00:18:56,720

made two hundred years before by

428

00:19:01,750 --> 00:18:58,880

timocheris of alexandria

429

00:19:04,470 --> 00:19:01,760

and he noticed a strange discrepancy

430

00:19:06,470 --> 00:19:04,480

the bright star spica was two degrees

431

00:19:09,029 --> 00:19:06,480

off in timacaris's chart from where

432

00:19:10,390 --> 00:19:09,039

hipparchus saw it in the sky

433

00:19:11,990 --> 00:19:10,400

two degrees

434

00:19:13,909 --> 00:19:12,000

if you stretch out both of your thumbs

435

00:19:16,549 --> 00:19:13,919

in front of you at arm's length that's

436

00:19:17,750 --> 00:19:16,559

about two degrees from end to end

437

00:19:18,950 --> 00:19:17,760

it's a small enough difference that i

438

00:19:21,029 --> 00:19:18,960

think most people would have looked at

439

00:19:22,150 --> 00:19:21,039

timocaris's chart and said

440

00:19:24,789 --> 00:19:22,160

no way

441

00:19:26,549 --> 00:19:24,799

the stars don't move not that much the

442

00:19:28,150 --> 00:19:26,559

heavens are supposed to be perfect right

443

00:19:31,110 --> 00:19:28,160

unchanging

444

00:19:33,029 --> 00:19:31,120

but timocharis but parkas had faith

445

00:19:34,950 --> 00:19:33,039

faith in timocharis a man who lived 200

446

00:19:36,230 --> 00:19:34,960

years before he was born

447

00:19:38,070 --> 00:19:36,240

faith that he had made a difficult

448

00:19:40,390 --> 00:19:38,080

observation

449

00:19:42,549 --> 00:19:40,400

it's the same kind of faith that we need

450

00:19:45,270 --> 00:19:42,559

today as scientists

451  
00:19:47,990 --> 00:19:45,280  
especially in astrobiology a field which

452  
00:19:49,669 --> 00:19:48,000  
combines disciplines combines expertise

453  
00:19:51,110 --> 00:19:49,679  
that takes more than one lifetime to

454  
00:19:53,190 --> 00:19:51,120  
accrue

455  
00:19:54,870 --> 00:19:53,200  
and on a deeper level when people say

456  
00:19:58,390 --> 00:19:54,880  
that science and faith are opposites i

457  
00:20:01,270 --> 00:19:58,400  
think what they mean is that faith is

458  
00:20:03,270 --> 00:20:01,280  
content with unexamined explanation

459  
00:20:05,110 --> 00:20:03,280  
whereas science requires deliberate

460  
00:20:08,230 --> 00:20:05,120  
exploration

461  
00:20:11,110 --> 00:20:08,240  
but science in a very real way does

462  
00:20:12,390 --> 00:20:11,120  
require faith faith in each other but in

463  
00:20:14,230 --> 00:20:12,400

a deeper way

464

00:20:15,270 --> 00:20:14,240

as hipparchus knew and as carl sagan

465

00:20:17,990 --> 00:20:15,280

once said

466

00:20:21,270 --> 00:20:18,000

faith that somewhere out there something

467

00:20:32,549 --> 00:20:21,280

incredible is waiting to be known

468

00:20:32,559 --> 00:20:37,830

michael chafin

469

00:20:42,149 --> 00:20:40,230

and now we're going to

470

00:20:44,549 --> 00:20:42,159

take three minutes of questions and

471

00:20:47,430 --> 00:20:44,559

comments from our judges that was

472

00:20:49,190 --> 00:20:47,440

wonderful michael incidentally

473

00:20:52,149 --> 00:20:49,200

judges

474

00:20:53,270 --> 00:20:52,159

michael that was great thank you um

475

00:20:54,710 --> 00:20:53,280

so

476

00:20:56,470 --> 00:20:54,720

as i understand it you're saying that

477

00:20:58,149 --> 00:20:56,480

even as scientists uh

478

00:21:00,149 --> 00:20:58,159

even though sometimes people say science

479

00:21:01,990 --> 00:21:00,159

doesn't require faith it does because

480

00:21:03,750 --> 00:21:02,000

you can't do every experiment yourself

481

00:21:06,070 --> 00:21:03,760

and you have to take other people's word

482

00:21:07,430 --> 00:21:06,080

for it so but then

483

00:21:08,789 --> 00:21:07,440

you can't take everybody's word for

484

00:21:11,029 --> 00:21:08,799

everything so

485

00:21:12,630 --> 00:21:11,039

how do you distinguish between what you

486

00:21:15,190 --> 00:21:12,640

should take on faith and and what you

487

00:21:17,270 --> 00:21:15,200

shouldn't ah it's a great question um so

488

00:21:19,029 --> 00:21:17,280

there is a practical way or a pragmatic

489

00:21:20,710 --> 00:21:19,039

way in which science does require faith

490

00:21:23,190 --> 00:21:20,720

right we can't go out there and repeat

491

00:21:24,870 --> 00:21:23,200

every experiment um but

492

00:21:26,470 --> 00:21:24,880

at the same time right there's a deeper

493

00:21:28,710 --> 00:21:26,480

level of faith that's required in

494

00:21:30,789 --> 00:21:28,720

science a faith that our brains which

495

00:21:32,549 --> 00:21:30,799

after all are evolved from single-celled

496

00:21:34,630 --> 00:21:32,559

organisms are capable of understanding

497

00:21:35,990 --> 00:21:34,640

and interpreting the universe

498

00:21:38,710 --> 00:21:36,000

i think it's very important right

499

00:21:40,789 --> 00:21:38,720

science is not all about faith

500

00:21:42,870 --> 00:21:40,799

fundamentally it's about let's see let's

501  
00:21:44,870 --> 00:21:42,880  
go out there and do experiments and test

502  
00:21:46,070 --> 00:21:44,880  
things about the universe right but

503  
00:21:48,070 --> 00:21:46,080  
there's a faith that we're all in that

504  
00:21:49,830 --> 00:21:48,080  
together that as a scientific community

505  
00:21:51,190 --> 00:21:49,840  
we can unravel the secrets of the

506  
00:21:54,710 --> 00:21:51,200  
universe and

507  
00:21:56,230 --> 00:21:54,720  
distill them into concrete statements

508  
00:21:57,669 --> 00:21:56,240  
thank you michael that was really a

509  
00:21:59,190 --> 00:21:57,679  
terrific presentation i particularly

510  
00:22:00,789 --> 00:21:59,200  
like your class and i have a very quick

511  
00:22:02,310 --> 00:22:00,799  
question and i like a very quick answer

512  
00:22:04,870 --> 00:22:02,320  
because we're limited to three minutes

513  
00:22:07,190 --> 00:22:04,880

sure when we when did you first

514

00:22:10,310 --> 00:22:07,200

become aware in your scientific career

515

00:22:13,590 --> 00:22:10,320

that you needed to operate on some faith

516

00:22:15,750 --> 00:22:13,600

uh well i don't know so i guess um

517

00:22:17,270 --> 00:22:15,760

it starts out the way that our education

518

00:22:19,190 --> 00:22:17,280

system operates

519

00:22:20,630 --> 00:22:19,200

uh it's sort of teacher in front of sage

520

00:22:22,070 --> 00:22:20,640

on a stage right there's a teacher in

521

00:22:23,669 --> 00:22:22,080

front of the room telling you things on

522

00:22:26,149 --> 00:22:23,679

faith right and sort of the i think

523

00:22:28,470 --> 00:22:26,159

everybody takes science on faith

524

00:22:30,870 --> 00:22:28,480

initially maybe the gap that you need to

525

00:22:33,110 --> 00:22:30,880

breach is to say i have faith that i can

526

00:22:35,350 --> 00:22:33,120

discover these things myself that as a

527

00:22:37,830 --> 00:22:35,360

community we can go out there and figure

528

00:22:38,470 --> 00:22:37,840

things out

529

00:23:35,270 --> 00:22:38,480

i

530

00:23:37,110 --> 00:23:35,280

our next contestant

531

00:23:39,590 --> 00:23:37,120

is kate fullette

532

00:23:42,070 --> 00:23:39,600

and she is an astronomer

533

00:23:44,149 --> 00:23:42,080

she's going to tell us

534

00:23:47,590 --> 00:23:44,159

that they call it

535

00:23:47,600 --> 00:23:59,590

for a reason

536

00:24:03,190 --> 00:24:01,590

when i talk to people about what i do

537

00:24:05,590 --> 00:24:03,200

which is to look for planets around

538

00:24:07,909 --> 00:24:05,600

other stars they almost never ask me

539

00:24:10,710 --> 00:24:07,919

questions about planets they want to

540

00:24:12,710 --> 00:24:10,720

know about aliens

541

00:24:14,230 --> 00:24:12,720

in fact no joke the gentleman sitting

542

00:24:16,549 --> 00:24:14,240

next to me on the plane on my way here

543

00:24:18,710 --> 00:24:16,559

to atlanta last week said

544

00:24:21,190 --> 00:24:18,720

so you're an astronomer why haven't you

545

00:24:22,549 --> 00:24:21,200

found e.t yet

546

00:24:24,549 --> 00:24:22,559

and i said

547

00:24:25,909 --> 00:24:24,559

you know i sense this frustration in him

548

00:24:27,590 --> 00:24:25,919

and in other people who ask me these

549

00:24:31,029 --> 00:24:27,600

questions and i want people to know that

550

00:24:32,789 --> 00:24:31,039

we really are trying it's not just uh

551  
00:24:35,029 --> 00:24:32,799  
laziness on our part that means that we

552  
00:24:37,909 --> 00:24:35,039  
haven't found a habitable planet yet

553  
00:24:40,630 --> 00:24:37,919  
it's fundamentally a problem of space

554  
00:24:42,390 --> 00:24:40,640  
after all we call it space

555  
00:24:44,390 --> 00:24:42,400  
for a reason

556  
00:24:46,230 --> 00:24:44,400  
so i want to do a simple model here to

557  
00:24:48,390 --> 00:24:46,240  
put that into context so i want you to

558  
00:24:50,870 --> 00:24:48,400  
imagine that this apple represents the

559  
00:24:54,390 --> 00:24:50,880  
entire earth everything you know and

560  
00:24:59,110 --> 00:24:57,269  
okay so if this is the earth then the

561  
00:25:01,350 --> 00:24:59,120  
moon would be about the size of a penny

562  
00:25:02,950 --> 00:25:01,360  
so our nearest nearest object to the

563  
00:25:04,390 --> 00:25:02,960

earth and this is the audience

564

00:25:06,070 --> 00:25:04,400

participation part i'm going to move it

565

00:25:08,070 --> 00:25:06,080

away from the apple and i want you guys

566

00:25:09,909 --> 00:25:08,080

to make some noise when you think i may

567

00:25:14,390 --> 00:25:09,919

have made a good model of the earth moon

568

00:25:19,430 --> 00:25:16,630

okay so about here-ish of course i fed

569

00:25:21,909 --> 00:25:19,440

them that but um

570

00:25:24,710 --> 00:25:21,919

here-ish is where most people guess but

571

00:25:26,870 --> 00:25:24,720

in reality i can't even stretch my arms

572

00:25:28,950 --> 00:25:26,880

out far enough so i'm going to need to

573

00:25:31,350 --> 00:25:28,960

set this apple down and move six and a

574

00:25:33,110 --> 00:25:31,360

half feet this way so here's my penny

575

00:25:35,029 --> 00:25:33,120

and i'm just gonna drop it because uh

576

00:25:36,950 --> 00:25:35,039

the moon is sterile and i though there's

577

00:25:39,029 --> 00:25:36,960

no life there so i'm gonna keep going

578

00:25:41,110 --> 00:25:39,039

and at this point i'm farther away from

579

00:25:43,350 --> 00:25:41,120

that apple than any human being has ever

580

00:25:44,950 --> 00:25:43,360

been from the earth

581

00:25:47,830 --> 00:25:44,960

and as i reach the edge of the stage

582

00:25:50,230 --> 00:25:47,840

here i'm not even anywhere near

583

00:25:53,190 --> 00:25:50,240

mars our nearest neighbor mars is in

584

00:25:55,029 --> 00:25:53,200

fact a quarter of a mile that way

585

00:25:56,710 --> 00:25:55,039

and the edge of our solar system where

586

00:25:58,870 --> 00:25:56,720

the voyager spacecraft are now so the

587

00:26:00,870 --> 00:25:58,880

farthest any man-made object has ever

588

00:26:02,549 --> 00:26:00,880

been from the earth that's four miles

589

00:26:03,830 --> 00:26:02,559

that way on the other side of downtown

590

00:26:05,590 --> 00:26:03,840

atlanta

591

00:26:07,430 --> 00:26:05,600

so when we're looking for planets around

592

00:26:09,750 --> 00:26:07,440

other stars we need to go to the nearest

593

00:26:11,350 --> 00:26:09,760

stars how far away are those

594

00:26:15,750 --> 00:26:11,360

our nearest star

595

00:26:17,909 --> 00:26:15,760

is 140 000 miles that way in this model

596

00:26:21,590 --> 00:26:17,919

that's halfway to the moon

597

00:26:24,710 --> 00:26:23,110

and at that distance what we're doing

598

00:26:27,350 --> 00:26:24,720

we're astronomers on that apple over

599

00:26:29,269 --> 00:26:27,360

there we're looking 140 000 miles away

600

00:26:31,510 --> 00:26:29,279

for another apple

601  
00:26:33,110 --> 00:26:31,520  
and in that context it seems like an

602  
00:26:34,950 --> 00:26:33,120  
impossible problem

603  
00:26:37,669 --> 00:26:34,960  
so you know i'm here to tell you it's

604  
00:26:40,070 --> 00:26:37,679  
possible in fact we've already found at

605  
00:26:42,149 --> 00:26:40,080  
those kinds of distances

606  
00:26:43,750 --> 00:26:42,159  
watermelons and cantaloupes and even

607  
00:26:45,830 --> 00:26:43,760  
grapefruits

608  
00:26:47,350 --> 00:26:45,840  
we just need a little bit more time to

609  
00:26:50,390 --> 00:26:47,360  
shrink the size of the fruit that we're

610  
00:26:52,710 --> 00:26:50,400  
finding until we find another apple out

611  
00:27:01,029 --> 00:26:52,720  
there in the cosmos and science catches

612  
00:27:01,039 --> 00:27:05,269  
judges

613  
00:27:08,710 --> 00:27:07,430

well first of all i'm hungry now um

614

00:27:09,350 --> 00:27:08,720

would you like

615

00:27:17,430 --> 00:27:09,360

it

616

00:27:18,870 --> 00:27:17,440

you on the plane when you head home and

617

00:27:21,350 --> 00:27:18,880

and you go through and you tell me how

618

00:27:24,070 --> 00:27:21,360

big space is so my answer or my question

619

00:27:27,430 --> 00:27:24,080

to you is if space is so big

620

00:27:29,269 --> 00:27:27,440

okay so how are we going to find et

621

00:27:30,950 --> 00:27:29,279

well i mean it's pretty remarkable the

622

00:27:33,110 --> 00:27:30,960

technology that we already have has

623

00:27:34,710 --> 00:27:33,120

allowed us and you know i was making a

624

00:27:36,470 --> 00:27:34,720

joke but we really have found things

625

00:27:38,870 --> 00:27:36,480

that are only a little bit bigger than

626

00:27:40,710 --> 00:27:38,880

the apple in this scale model we've

627

00:27:42,149 --> 00:27:40,720

found super ears that are a couple times

628

00:27:43,430 --> 00:27:42,159

bigger than the apple which is why i use

629

00:27:44,310 --> 00:27:43,440

the grapefruit

630

00:27:47,909 --> 00:27:44,320

so

631

00:27:49,430 --> 00:27:47,919

hope that you know technological

632

00:27:51,110 --> 00:27:49,440

improvement will continue and we'll

633

00:27:53,510 --> 00:27:51,120

we'll be able to find one that's great

634

00:27:57,510 --> 00:27:55,750

very nice job i really liked your fruit

635

00:27:58,710 --> 00:27:57,520

metaphors and how did you come up with

636

00:28:01,029 --> 00:27:58,720

the fruit was it because fruit was

637

00:28:02,630 --> 00:28:01,039

sitting outside in the lobby all day

638

00:28:08,070 --> 00:28:02,640

well i used to use a tennis ball but i

639

00:28:11,350 --> 00:28:09,669

so you think so we're going to find

640

00:28:12,549 --> 00:28:11,360

these apples pretty soon but then how

641

00:28:16,310 --> 00:28:12,559

are you going to figure out if there are

642

00:28:19,909 --> 00:28:18,310

that's not a problem that i have to

643

00:28:31,669 --> 00:28:19,919

investigate

644

00:28:31,679 --> 00:28:36,950

thank you kate

645

00:28:36,960 --> 00:28:41,350

warmer than apple

646

00:28:41,360 --> 00:28:46,310

hold on

647

00:28:51,750 --> 00:28:48,549

okay judges while they're doing their

648

00:29:03,669 --> 00:28:56,149

judge

649

00:29:05,430 --> 00:29:03,679

minutes are up

650

00:29:07,350 --> 00:29:05,440

our next

651  
00:29:09,110 --> 00:29:07,360  
is heather graham

652  
00:29:11,190 --> 00:29:09,120  
she's an organic

653  
00:29:13,110 --> 00:29:11,200  
geochemist

654  
00:29:17,430 --> 00:29:13,120  
and she's going to talk about

655  
00:29:19,029 --> 00:29:17,440  
hashtag occupy the universe

656  
00:29:31,190 --> 00:29:19,039  
a hashtag

657  
00:29:35,830 --> 00:29:33,110  
i have a confession to make to all of

658  
00:29:39,350 --> 00:29:35,840  
you and this is very unpopular for me to

659  
00:29:41,029 --> 00:29:39,360  
say but i'm a one percenter

660  
00:29:41,990 --> 00:29:41,039  
i'm part of the one percent you've heard

661  
00:29:44,149 --> 00:29:42,000  
about

662  
00:29:45,830 --> 00:29:44,159  
actually david is as well

663  
00:29:47,830 --> 00:29:45,840

you should know and strangely enough so

664

00:29:49,510 --> 00:29:47,840

is his hat

665

00:29:50,870 --> 00:29:49,520

but before you raise our taxes you

666

00:29:53,350 --> 00:29:50,880

should probably know that all of you are

667

00:29:54,950 --> 00:29:53,360

one percenters as well and all the

668

00:29:56,789 --> 00:29:54,960

occupiers on wall street are one

669

00:29:59,029 --> 00:29:56,799

percenters in fact everyone on the

670

00:30:01,190 --> 00:29:59,039

planet including our planet and all the

671

00:30:02,549 --> 00:30:01,200

other planets out there were all one

672

00:30:04,070 --> 00:30:02,559

percenters

673

00:30:06,549 --> 00:30:04,080

so you're probably wondering what makes

674

00:30:08,470 --> 00:30:06,559

us all part of this exclusive group and

675

00:30:10,870 --> 00:30:08,480

it's because we're made of matter

676

00:30:13,510 --> 00:30:10,880

so that means we have volume we take up

677

00:30:14,789 --> 00:30:13,520

space and we have mass sometimes more

678

00:30:16,870 --> 00:30:14,799

than we'll admit to

679

00:30:18,389 --> 00:30:16,880

and we can be detected visually with the

680

00:30:20,149 --> 00:30:18,399

senses

681

00:30:21,990 --> 00:30:20,159

but nearly 99

682

00:30:24,389 --> 00:30:22,000

most of the universe out there we can't

683

00:30:26,149 --> 00:30:24,399

see can't be detected visually

684

00:30:29,190 --> 00:30:26,159

but even though we can't see it we have

685

00:30:30,870 --> 00:30:29,200

ways of knowing that the 99 is out there

686

00:30:33,029 --> 00:30:30,880

one of the ways that we know is we look

687

00:30:35,430 --> 00:30:33,039

out with telescopes into space and we

688

00:30:37,350 --> 00:30:35,440

see these big hot clouds of gas out

689

00:30:39,590 --> 00:30:37,360

there but they're not acting like a

690

00:30:41,110 --> 00:30:39,600

cloud they're not dispersing instead

691

00:30:43,830 --> 00:30:41,120

they're being held together very

692

00:30:45,510 --> 00:30:43,840

strongly by gravitational force

693

00:30:48,070 --> 00:30:45,520

and you remember that gravity is the

694

00:30:49,909 --> 00:30:48,080

attractive force between two masses so

695

00:30:52,230 --> 00:30:49,919

that means there's some big mass in that

696

00:30:54,149 --> 00:30:52,240

cloud that we can't see that's holding

697

00:30:55,750 --> 00:30:54,159

it together

698

00:30:57,110 --> 00:30:55,760

so another way that we have detecting

699

00:30:59,269 --> 00:30:57,120

the 99

700

00:31:01,430 --> 00:30:59,279

is we can try to estimate the mass of

701  
00:31:03,509 --> 00:31:01,440  
galaxies and we do that by using the

702  
00:31:06,389 --> 00:31:03,519  
motion of objects within them and when

703  
00:31:07,990 --> 00:31:06,399  
we calculate that mass of a galaxy it's

704  
00:31:10,710 --> 00:31:08,000  
much much greater than if we were just

705  
00:31:12,549 --> 00:31:10,720  
to count up all the individual masses of

706  
00:31:14,149 --> 00:31:12,559  
the luminous objects in the galaxy

707  
00:31:15,669 --> 00:31:14,159  
things like stars and dust that are

708  
00:31:17,350 --> 00:31:15,679  
lighting up

709  
00:31:19,830 --> 00:31:17,360  
so that means there's some big mass in

710  
00:31:22,310 --> 00:31:19,840  
that galaxy contributing to its total

711  
00:31:24,230 --> 00:31:22,320  
total weight that's not lighting up so

712  
00:31:25,590 --> 00:31:24,240  
we call it dark matter

713  
00:31:27,029 --> 00:31:25,600

but now that you know that you're all

714

00:31:28,310 --> 00:31:27,039

part of the elite one percent you're

715

00:31:30,470 --> 00:31:28,320

probably wondering why we should even

716

00:31:33,669 --> 00:31:30,480

care about the 99 percent i mean

717

00:31:39,029 --> 00:31:36,950

but actually the 99 is pretty important

718

00:31:41,590 --> 00:31:39,039

without that big mass in that galaxy it

719

00:31:42,950 --> 00:31:41,600

might just fly apart for lack of gravity

720

00:31:44,950 --> 00:31:42,960

and this is going to sound very

721

00:31:48,389 --> 00:31:44,960

melodramatic but actually the fate of

722

00:31:50,310 --> 00:31:48,399

the universe depends on the 99 percent

723

00:31:52,470 --> 00:31:50,320

see our universe is locked in a struggle

724

00:31:54,630 --> 00:31:52,480

right now between the leftover momentum

725

00:31:56,389 --> 00:31:54,640

of expansion from the big bang and the

726

00:31:57,990 --> 00:31:56,399

gravity of all the objects within it

727

00:32:00,470 --> 00:31:58,000

that hold it together

728

00:32:02,149 --> 00:32:00,480

and if at any point that gravity becomes

729

00:32:04,230 --> 00:32:02,159

bigger than that outward momentum of

730

00:32:06,070 --> 00:32:04,240

expansion our universe will crunch in

731

00:32:08,389 --> 00:32:06,080

and collapse on itself

732

00:32:09,909 --> 00:32:08,399

but luckily some of that 99 out there

733

00:32:12,070 --> 00:32:09,919

has this very strange trait we don't

734

00:32:14,149 --> 00:32:12,080

really understand yet that's exerting a

735

00:32:15,750 --> 00:32:14,159

negative pressure on the universe so

736

00:32:18,070 --> 00:32:15,760

instead of falling in on ourselves we're

737

00:32:19,830 --> 00:32:18,080

expanding at an ever greater rate

738

00:32:21,509 --> 00:32:19,840

so that means for us one percenters

739

00:32:32,230 --> 00:32:21,519

every day we're not squished by our own

740

00:32:36,070 --> 00:32:34,389

judges

741

00:32:37,990 --> 00:32:36,080

thank you heather that was a very nicely

742

00:32:40,310 --> 00:32:38,000

constructed narrative and i thank you

743

00:32:42,710 --> 00:32:40,320

for that

744

00:32:43,909 --> 00:32:42,720

yeah it was great um so but

745

00:32:45,830 --> 00:32:43,919

while we have you here i just have to

746

00:32:48,950 --> 00:32:45,840

know so what is the fate of the universe

747

00:32:54,630 --> 00:32:51,269

oh oh i'm not at liberty to say i'm so

748

00:32:58,310 --> 00:32:56,070

i thought it was terrific i think you

749

00:32:59,750 --> 00:32:58,320

know the the thing about

750

00:33:01,430 --> 00:32:59,760

the thing you've done well here is

751

00:33:02,789 --> 00:33:01,440

you've taken a construct that we all

752

00:33:04,549 --> 00:33:02,799

have heard about obviously in the news

753

00:33:06,070 --> 00:33:04,559

for the last however many months and

754

00:33:08,789 --> 00:33:06,080

made us all think about it and you know

755

00:33:10,310 --> 00:33:08,799

and and drawn this great analogy so a

756

00:33:11,669 --> 00:33:10,320

really nice job tonight i've been

757

00:33:13,590 --> 00:33:11,679

desperately afraid that people will

758

00:33:16,549 --> 00:33:13,600

forget about the aquify museum before

759

00:33:16,559 --> 00:33:19,750

terrific thank you

760

00:33:25,990 --> 00:33:21,029

thank you

761

00:33:32,630 --> 00:33:29,430

our next speaker is noah hammond

762

00:33:36,870 --> 00:33:32,640

noah is a planetary scientist who speak

763

00:33:41,909 --> 00:33:36,880

about the late heavy bombardment

764

00:33:49,909 --> 00:33:41,919

the solar system's civil war

765

00:33:55,350 --> 00:33:52,230

the most violent time in the history of

766

00:33:57,509 --> 00:33:55,360

the earth was 4 billion years ago during

767

00:33:59,029 --> 00:33:57,519

what i like to call the solar system's

768

00:34:01,430 --> 00:33:59,039

civil war

769

00:34:02,230 --> 00:34:01,440

so it had profound effects for life on

770

00:34:04,830 --> 00:34:02,240

earth

771

00:34:07,669 --> 00:34:04,840

and implications for life in the

772

00:34:11,829 --> 00:34:07,679

universe so let's pretend michelle

773

00:34:13,589 --> 00:34:11,839

nichols is the sun or our star

774

00:34:16,950 --> 00:34:13,599

so right next to her we have the inner

775

00:34:19,669 --> 00:34:16,960

solar system among them earth

776  
00:34:20,790 --> 00:34:19,679  
fragile maybe with oceans and life on it

777  
00:34:23,430 --> 00:34:20,800  
at this time

778  
00:34:24,629 --> 00:34:23,440  
and out here we have jupiter

779  
00:34:27,349 --> 00:34:24,639  
and saturn

780  
00:34:28,710 --> 00:34:27,359  
the enemies of earth

781  
00:34:30,790 --> 00:34:28,720  
so they get into this kind of

782  
00:34:32,869 --> 00:34:30,800  
gravitational tug of war

783  
00:34:34,869 --> 00:34:32,879  
where as they pass close to one another

784  
00:34:36,869 --> 00:34:34,879  
in their orbits they attract each other

785  
00:34:39,190 --> 00:34:36,879  
with their immense gravities and that

786  
00:34:41,669 --> 00:34:39,200  
changes their orbits dramatically

787  
00:34:43,750 --> 00:34:41,679  
and the asteroid belt right next to it

788  
00:34:46,470 --> 00:34:43,760

is some of it is flung through the inner

789

00:34:48,950 --> 00:34:46,480

solar system attacking the inner planets

790

00:34:50,710 --> 00:34:48,960

bombarding their surfaces

791

00:34:52,950 --> 00:34:50,720

this is a theory

792

00:34:55,430 --> 00:34:52,960

called the late heavy bombardment

793

00:34:56,470 --> 00:34:55,440

and the evidence for it comes from the

794

00:35:00,710 --> 00:34:56,480

moon

795

00:35:03,349 --> 00:35:00,720

collected samples from some of the

796

00:35:05,589 --> 00:35:03,359

largest impact craters and we dated

797

00:35:08,470 --> 00:35:05,599

those samples to all be around the same

798

00:35:11,190 --> 00:35:08,480

age of 4 billion years ago

799

00:35:13,910 --> 00:35:11,200

so that means if the moon was impacted

800

00:35:16,710 --> 00:35:13,920

the earth was even more so its larger

801  
00:35:17,990 --> 00:35:16,720  
gravity would pull in more impactors

802  
00:35:19,910 --> 00:35:18,000  
so

803  
00:35:23,190 --> 00:35:19,920  
picture this in your mind's eye

804  
00:35:25,910 --> 00:35:23,200  
an asteroid so immense that it careens

805  
00:35:28,230 --> 00:35:25,920  
through the atmosphere and

806  
00:35:30,790 --> 00:35:28,240  
boom impacts the atlantic ocean and

807  
00:35:32,870 --> 00:35:30,800  
boils off all the water this is how

808  
00:35:34,310 --> 00:35:32,880  
extreme we think this event might have

809  
00:35:36,630 --> 00:35:34,320  
been

810  
00:35:38,230 --> 00:35:36,640  
so it's very likely that life on the

811  
00:35:39,750 --> 00:35:38,240  
surface of the earth

812  
00:35:41,109 --> 00:35:39,760  
would not have been able to survive this

813  
00:35:44,230 --> 00:35:41,119

event

814

00:35:46,310 --> 00:35:44,240

but if it lived below the surface

815

00:35:48,710 --> 00:35:46,320

shielded from the chaos above

816

00:35:52,150 --> 00:35:48,720

it might have and there are organisms

817

00:35:53,990 --> 00:35:52,160

which we know can live in that area

818

00:35:55,910 --> 00:35:54,000

a second possibility

819

00:35:57,349 --> 00:35:55,920

is that life had to arrive

820

00:35:59,829 --> 00:35:57,359

after this event

821

00:36:01,670 --> 00:35:59,839

in which case it did so very quickly

822

00:36:03,750 --> 00:36:01,680

because some of the first chemical

823

00:36:06,470 --> 00:36:03,760

evidence of life

824

00:36:08,230 --> 00:36:06,480

we find happens just after this solar

825

00:36:10,150 --> 00:36:08,240

system civil war

826

00:36:12,550 --> 00:36:10,160

so that means it didn't take as long as

827

00:36:15,109 --> 00:36:12,560

we thought to go from atoms and

828

00:36:16,470 --> 00:36:15,119

molecules to some of the first living

829

00:36:19,270 --> 00:36:16,480

organisms

830

00:36:21,750 --> 00:36:19,280

and if it didn't take long for life to

831

00:36:23,990 --> 00:36:21,760

arise on this planet

832

00:36:26,150 --> 00:36:24,000

it might not take long for life to arise

833

00:36:27,670 --> 00:36:26,160

on other planets in other parts of the

834

00:36:30,310 --> 00:36:27,680

galaxy

835

00:36:31,910 --> 00:36:30,320

so from the solar system civil war we

836

00:36:33,750 --> 00:36:31,920

learned that the probability of lives

837

00:36:35,030 --> 00:36:33,760

elsewhere might be higher than we

838

00:36:41,030 --> 00:36:35,040

thought

839

00:36:41,040 --> 00:36:44,230

judges

840

00:36:49,510 --> 00:36:47,270

nice job noah and uh encouraging uh

841

00:36:51,910 --> 00:36:49,520

punchline i like to think of

842

00:36:53,670 --> 00:36:51,920

the chances being good out there about i

843

00:36:55,829 --> 00:36:53,680

have a question so you said that jupiter

844

00:36:57,670 --> 00:36:55,839

is the enemy of earth but we often hear

845

00:37:00,390 --> 00:36:57,680

about in astrobiology about jupiter

846

00:37:02,230 --> 00:37:00,400

protecting the earth from

847

00:37:04,710 --> 00:37:02,240

a greater number of impacts that we

848

00:37:07,109 --> 00:37:04,720

would have if jupiter wasn't fending off

849

00:37:10,230 --> 00:37:07,119

the asteroids and comets so

850

00:37:13,109 --> 00:37:10,240

when and why did jupiter switch sides

851  
00:37:15,430 --> 00:37:13,119  
that turn cloak yeah well what we know

852  
00:37:18,950 --> 00:37:15,440  
is that uh since jupiter the largest

853  
00:37:22,870 --> 00:37:18,960  
planet has a very large effect on comets

854  
00:37:25,990 --> 00:37:22,880  
and asteroids uh near its orbit and so

855  
00:37:29,430 --> 00:37:26,000  
at that time it got into this two one

856  
00:37:32,710 --> 00:37:29,440  
resonance with saturn which moved it

857  
00:37:35,349 --> 00:37:32,720  
around and it exerted its influence on

858  
00:37:38,150 --> 00:37:35,359  
the solar system and now today

859  
00:37:39,030 --> 00:37:38,160  
uh it's in a more stable orbit

860  
00:37:41,990 --> 00:37:39,040  
and

861  
00:37:43,990 --> 00:37:42,000  
uh it you know many uh things are still

862  
00:37:45,670 --> 00:37:44,000  
impacting it like the shoemaker levy

863  
00:37:47,030 --> 00:37:45,680

comet that we saw today when when that

864

00:37:48,630 --> 00:37:47,040

came out it's like oh thank you our

865

00:37:50,950 --> 00:37:48,640

protector jupiter

866

00:37:52,470 --> 00:37:50,960

so uh like the key message is it has a

867

00:37:54,310 --> 00:37:52,480

very strong influence on the solar

868

00:37:56,069 --> 00:37:54,320

system

869

00:37:58,150 --> 00:37:56,079

great job noah thank you i have a

870

00:38:00,710 --> 00:37:58,160

question if you were a micro with a

871

00:38:03,030 --> 00:38:00,720

movie camera standing behind a rock four

872

00:38:05,030 --> 00:38:03,040

billion years ago on early earth during

873

00:38:07,829 --> 00:38:05,040

the late having bombardment what would

874

00:38:10,470 --> 00:38:07,839

you see i mean are we seeing bombardment

875

00:38:12,630 --> 00:38:10,480

every day every week every month every

876

00:38:14,710 --> 00:38:12,640

few years can you give us just quickly

877

00:38:16,470 --> 00:38:14,720

like a picture of what you would see oh

878

00:38:18,390 --> 00:38:16,480

that's a tough question

879

00:38:20,550 --> 00:38:18,400

and you know if we had a time machine i

880

00:38:22,870 --> 00:38:20,560

might like to go back and see that but

881

00:38:25,109 --> 00:38:22,880

then i want to take some protective gear

882

00:38:27,510 --> 00:38:25,119

uh it's difficult to really say i know

883

00:38:30,230 --> 00:38:27,520

that uh you know the moon has many very

884

00:38:31,190 --> 00:38:30,240

large impact craters on it and

885

00:38:35,349 --> 00:38:31,200

the

886

00:38:38,230 --> 00:38:35,359

being bombarded which is over a period

887

00:38:41,190 --> 00:38:38,240

of around 200 million years uh there was

888

00:38:43,750 --> 00:38:41,200

some very humongous impacts

889

00:38:46,390 --> 00:38:43,760

and how far apart they were spaced i

890

00:38:48,870 --> 00:38:46,400

can't exactly say off the top of my head

891

00:38:49,990 --> 00:38:48,880

but it's an excellent question

892

00:38:52,870 --> 00:38:50,000

i don't know if i could top that

893

00:38:53,829 --> 00:38:52,880

question um so you know no obviously

894

00:38:55,589 --> 00:38:53,839

you've got great skills as a

895

00:38:56,870 --> 00:38:55,599

communicator

896

00:38:58,550 --> 00:38:56,880

you know and there's a lot of great

897

00:39:00,550 --> 00:38:58,560

scientists here in the room

898

00:39:01,910 --> 00:39:00,560

why do you wanna why do you wanna not

899

00:39:03,109 --> 00:39:01,920

only do science but communicate it

900

00:39:05,349 --> 00:39:03,119

what's what's so important about it to

901  
00:39:08,150 --> 00:39:05,359  
you well i think that there's just so

902  
00:39:11,030 --> 00:39:08,160  
many cool stories about the universe

903  
00:39:13,910 --> 00:39:11,040  
that nobody's really heard of before and

904  
00:39:15,670 --> 00:39:13,920  
uh telling them it's just so much fun

905  
00:39:16,710 --> 00:39:15,680  
that's the short answer in a nutshell

906  
00:39:21,829 --> 00:39:16,720  
right there

907  
00:39:21,839 --> 00:39:26,870  
thank you noah

908  
00:39:30,390 --> 00:39:29,190  
we're now going we're now going to hear

909  
00:39:32,310 --> 00:39:30,400  
from

910  
00:39:52,069 --> 00:39:32,320  
lucas joel

911  
00:39:55,270 --> 00:39:52,079  
lucas is a paleontologist

912  
00:39:57,190 --> 00:39:55,280  
and lucas is going to explore the

913  
00:39:58,870 --> 00:39:57,200

curious case

914

00:40:00,390 --> 00:39:58,880

of the first

915

00:40:03,910 --> 00:40:00,400

animal

916

00:40:03,920 --> 00:40:14,950

lucas

917

00:40:19,270 --> 00:40:17,349

we all love a good detective story

918

00:40:21,990 --> 00:40:19,280

because detectives ask the most

919

00:40:23,910 --> 00:40:22,000

intriguing questions who did it who

920

00:40:25,069 --> 00:40:23,920

committed the murder who stole the

921

00:40:27,270 --> 00:40:25,079

jewels

922

00:40:29,030 --> 00:40:27,280

paleontologists which are scientists

923

00:40:31,030 --> 00:40:29,040

that study fossils

924

00:40:32,150 --> 00:40:31,040

ask many of the same detective-like

925

00:40:33,670 --> 00:40:32,160

questions

926

00:40:35,190 --> 00:40:33,680

how did this animal which is now a

927

00:40:36,630 --> 00:40:35,200

fossil die

928

00:40:38,710 --> 00:40:36,640

how did it live

929

00:40:41,510 --> 00:40:38,720

one big problem paleontologists face

930

00:40:43,430 --> 00:40:41,520

however is their fossils or their crime

931

00:40:44,950 --> 00:40:43,440

scenes have sometimes been left out in

932

00:40:46,710 --> 00:40:44,960

the heat and rain for millions and

933

00:40:48,309 --> 00:40:46,720

millions of years

934

00:40:49,270 --> 00:40:48,319

this can make mystery solving a little

935

00:40:51,510 --> 00:40:49,280

difficult

936

00:40:53,510 --> 00:40:51,520

but what if we could go back in time to

937

00:40:55,190 --> 00:40:53,520

the scene of the crime to see these

938

00:40:57,109 --> 00:40:55,200

animals that they once were

939

00:40:59,510 --> 00:40:57,119

well lucky for us

940

00:41:01,270 --> 00:40:59,520

i'm a time traveling detective

941

00:41:04,230 --> 00:41:01,280

and we can use my magical time machine

942

00:41:05,910 --> 00:41:04,240

to go back and on this trip solve one of

943

00:41:08,390 --> 00:41:05,920

the greatest fossil mysteries of all

944

00:41:10,870 --> 00:41:08,400

time that is what was the first animal

945

00:41:13,270 --> 00:41:10,880

to ever move so why waste any time let's

946

00:41:17,910 --> 00:41:13,280

get going back to the jurassic period

947

00:41:22,230 --> 00:41:20,230

step out what do we see well dinosaurs

948

00:41:24,390 --> 00:41:22,240

of course they're everywhere look

949

00:41:26,790 --> 00:41:24,400

there's a massive stegosaurus lumbering

950

00:41:29,190 --> 00:41:26,800

along dinosaurs all around all of them

951  
00:41:30,230 --> 00:41:29,200  
moving but is this the first animal

952  
00:41:31,109 --> 00:41:30,240  
movement

953  
00:41:32,710 --> 00:41:31,119  
no

954  
00:41:34,550 --> 00:41:32,720  
life spans the past three and a half

955  
00:41:36,069 --> 00:41:34,560  
billion years of the earth's history we

956  
00:41:38,069 --> 00:41:36,079  
have to go way back to see the first

957  
00:41:39,349 --> 00:41:38,079  
animal movement so back into the time

958  
00:41:41,510 --> 00:41:39,359  
machine

959  
00:41:44,470 --> 00:41:41,520  
an additional 400 million years into the

960  
00:41:48,790 --> 00:41:46,470  
step out and where are we we're in the

961  
00:41:51,510 --> 00:41:48,800  
ediacaran period of geologic time there

962  
00:41:53,589 --> 00:41:51,520  
are no land plants no land animals but

963  
00:41:56,630 --> 00:41:53,599

if we swim out beneath the waves we see

964

00:41:58,150 --> 00:41:56,640

a gorgeous scene a garden of alien-like

965

00:41:59,270 --> 00:41:58,160

life-forms that we can see with the

966

00:42:01,270 --> 00:41:59,280

naked eye

967

00:42:03,829 --> 00:42:01,280

for the first three billion years of the

968

00:42:05,750 --> 00:42:03,839

history of life life was microscopic you

969

00:42:07,349 --> 00:42:05,760

couldn't see it but now we can see

970

00:42:08,950 --> 00:42:07,359

things with naked eye

971

00:42:11,270 --> 00:42:08,960

first glance everything we see is

972

00:42:13,349 --> 00:42:11,280

stationary nothing's moving

973

00:42:15,270 --> 00:42:13,359

but wait what's that there's a tiny

974

00:42:17,109 --> 00:42:15,280

little worm moving through the sand

975

00:42:18,390 --> 00:42:17,119

pushing aside grains that are almost as

976  
00:42:20,710 --> 00:42:18,400  
big as he is

977  
00:42:23,109 --> 00:42:20,720  
this is the first animal movement while

978  
00:42:25,349 --> 00:42:23,119  
small this worm has huge implications

979  
00:42:27,589 --> 00:42:25,359  
for all life that's because this worm is

980  
00:42:29,270 --> 00:42:27,599  
a biliterion a bilaterian is an animal

981  
00:42:31,430 --> 00:42:29,280  
with bilateral symmetry up and down the

982  
00:42:34,550 --> 00:42:31,440  
midline as well as the through going gut

983  
00:42:36,870 --> 00:42:34,560  
like you me dinosaurs mosquitoes

984  
00:42:38,950 --> 00:42:36,880  
what bilaterans also have is a body

985  
00:42:40,950 --> 00:42:38,960  
cavity and this is the key feature

986  
00:42:42,069 --> 00:42:40,960  
enabling this bilaterian to move through

987  
00:42:43,910 --> 00:42:42,079  
the sand

988  
00:42:47,030 --> 00:42:43,920

so really this little guy is all a

989

00:42:48,710 --> 00:42:47,040

spilotarians in one remarkable i'd say

990

00:42:50,630 --> 00:42:48,720

that until we discover an even older

991

00:42:52,950 --> 00:42:50,640

moving animal we've solved the mystery

992

00:42:53,990 --> 00:42:52,960

of the first animal movement

993

00:42:57,270 --> 00:42:54,000

so

994

00:42:59,430 --> 00:42:57,280

could move

995

00:43:01,750 --> 00:42:59,440

but what's even more singular

996

00:43:04,230 --> 00:43:01,760

is that this worm is part of the dawn of

997

00:43:04,950 --> 00:43:04,240

complex life on this planet

998

00:43:06,550 --> 00:43:04,960

so

999

00:43:08,790 --> 00:43:06,560

because we've already run this early

1000

00:43:10,790 --> 00:43:08,800

evolutionary experiment here on earth it

1001  
00:43:12,550 --> 00:43:10,800  
gives us a framework or a search image

1002  
00:43:14,069 --> 00:43:12,560  
for how life might evolve on a distant

1003  
00:43:16,309 --> 00:43:14,079  
exoplanet

1004  
00:43:17,670 --> 00:43:16,319  
and life on another planet well that

1005  
00:43:26,230 --> 00:43:17,680  
sounds to me like a mystery worth

1006  
00:43:31,349 --> 00:43:29,030  
thank you joel judges

1007  
00:43:33,349 --> 00:43:31,359  
very nice lucas and and you know always

1008  
00:43:35,750 --> 00:43:33,359  
great when you can use props to uh to

1009  
00:43:37,430 --> 00:43:35,760  
reinforce your case um

1010  
00:43:39,349 --> 00:43:37,440  
so

1011  
00:43:42,309 --> 00:43:39,359  
you get up and you're and you you're

1012  
00:43:44,230 --> 00:43:42,319  
talking to a group of of

1013  
00:43:45,589 --> 00:43:44,240

sixth graders yes i mean science

1014

00:43:47,349 --> 00:43:45,599

communication you know is often about

1015

00:43:49,589 --> 00:43:47,359

getting them young

1016

00:43:52,150 --> 00:43:49,599

do you can you maintain that level of

1017

00:43:53,589 --> 00:43:52,160

energy the whole time or do you

1018

00:43:56,230 --> 00:43:53,599

i don't know i'm not as young as i used

1019

00:43:59,270 --> 00:43:57,829

well excellent and and i and i

1020

00:44:00,710 --> 00:43:59,280

particularly like your use of sound

1021

00:44:02,470 --> 00:44:00,720

effects because i'm convinced that's

1022

00:44:04,710 --> 00:44:02,480

exact sound that a time machine would

1023

00:44:06,870 --> 00:44:04,720

make uh if you were to go back in time

1024

00:44:09,270 --> 00:44:06,880

so very nice

1025

00:44:10,950 --> 00:44:09,280

great job lucas thank you i have two

1026

00:44:12,710 --> 00:44:10,960

quick questions uh who's your favorite

1027

00:44:15,750 --> 00:44:12,720

detective and if you could choose a

1028

00:44:17,430 --> 00:44:15,760

planet to go on your own mission to look

1029

00:44:19,990 --> 00:44:17,440

for life there what would you choose

1030

00:44:22,790 --> 00:44:20,000

planet or planetary body

1031

00:44:24,230 --> 00:44:22,800

my favorite detective

1032

00:44:25,349 --> 00:44:24,240

um

1033

00:44:27,349 --> 00:44:25,359

well

1034

00:44:28,870 --> 00:44:27,359

i have to pay homage to sherlock holmes

1035

00:44:32,550 --> 00:44:28,880

i never said his name while i was up

1036

00:44:36,390 --> 00:44:34,230

if he had been

1037

00:44:38,710 --> 00:44:36,400

a scientist he was a scientist but if he

1038

00:44:39,990 --> 00:44:38,720

had been one that we in the way we think

1039

00:44:44,950 --> 00:44:40,000

of it he would have been a

1040

00:44:49,190 --> 00:44:47,510

that was great um

1041

00:44:52,069 --> 00:44:49,200

this is sort of a nerdy question maybe

1042

00:44:54,870 --> 00:44:52,079

but what about the little um

1043

00:44:57,270 --> 00:44:54,880

bacteria with cilia that swim around um

1044

00:44:59,349 --> 00:44:57,280

why why aren't they the first uh

1045

00:45:00,790 --> 00:44:59,359

animal movement so this is the first

1046

00:45:02,069 --> 00:45:00,800

animal movement

1047

00:45:07,270 --> 00:45:02,079

so they're cells they don't count as

1048

00:45:19,030 --> 00:45:10,150

it was thank you thanks a lot

1049

00:45:19,040 --> 00:45:22,390

our next

1050

00:45:27,390 --> 00:45:26,069

contestant is on the fam lab staged

1051  
00:45:29,510 --> 00:45:27,400  
coming up

1052  
00:45:33,750 --> 00:45:29,520  
astrophysicist brendan mullen i'll be

1053  
00:45:39,670 --> 00:45:36,630  
brendan wants to know

1054  
00:45:42,069 --> 00:45:39,680  
where are the aliens

1055  
00:45:55,270 --> 00:45:42,079  
where's brendan i'm right here i want to

1056  
00:45:58,470 --> 00:45:56,710  
i haven't sold it yet in case you're

1057  
00:46:00,550 --> 00:45:58,480  
wondering

1058  
00:46:02,630 --> 00:46:00,560  
which is weird because you know this is

1059  
00:46:05,589 --> 00:46:02,640  
prime real estate here

1060  
00:46:07,030 --> 00:46:05,599  
we're on a planet rich in liquid water

1061  
00:46:09,349 --> 00:46:07,040  
and breathable air

1062  
00:46:11,430 --> 00:46:09,359  
at just the right distance from the sun

1063  
00:46:13,430 --> 00:46:11,440

we've got an asteroid belt right in our

1064

00:46:15,430 --> 00:46:13,440

backyard full of plenty of raw materials

1065

00:46:18,150 --> 00:46:15,440

for building spaceships or silver

1066

00:46:19,829 --> 00:46:18,160

jumpsuits or whatever aliens do

1067

00:46:21,829 --> 00:46:19,839

it just it doesn't make sense you know

1068

00:46:23,829 --> 00:46:21,839

like i should be swarmed with potential

1069

00:46:26,550 --> 00:46:23,839

buyers now because you know it's not

1070

00:46:28,470 --> 00:46:26,560

that hard to travel between the stars

1071

00:46:30,550 --> 00:46:28,480

seriously i mean we could do it if we

1072

00:46:33,670 --> 00:46:30,560

really wanted to in just a few

1073

00:46:35,670 --> 00:46:33,680

generations time ambition and innovation

1074

00:46:38,150 --> 00:46:35,680

we could propel astronauts out of the

1075

00:46:39,109 --> 00:46:38,160

solar system at a tenth of the speed of

1076

00:46:40,309 --> 00:46:39,119

light

1077

00:46:42,470 --> 00:46:40,319

if that were you

1078

00:46:44,630 --> 00:46:42,480

now you would be halfway to the moon by

1079

00:46:46,069 --> 00:46:44,640

the time i finish the sentence

1080

00:46:48,069 --> 00:46:46,079

it's fast

1081

00:46:50,309 --> 00:46:48,079

in decades a century of travel the

1082

00:46:52,630 --> 00:46:50,319

nearest stars and the planets that orbit

1083

00:46:54,950 --> 00:46:52,640

around them would be yours or your

1084

00:46:56,630 --> 00:46:54,960

descendants more likely after settling

1085

00:46:58,630 --> 00:46:56,640

down for a while they could send out

1086

00:47:00,150 --> 00:46:58,640

their own pioneers and reach more

1087

00:47:02,630 --> 00:47:00,160

distant stars

1088

00:47:04,550 --> 00:47:02,640

and over time waves of our interstellar

1089

00:47:06,950 --> 00:47:04,560

voyagers would cascade across the

1090

00:47:09,349 --> 00:47:06,960

fertile worlds of the cosmos

1091

00:47:10,390 --> 00:47:09,359

and if we can do that so could someone

1092

00:47:12,390 --> 00:47:10,400

else right

1093

00:47:14,710 --> 00:47:12,400

well starting from just about anywhere

1094

00:47:17,510 --> 00:47:14,720

you can see in the night sky another

1095

00:47:18,870 --> 00:47:17,520

civilization could leapfrog star to star

1096

00:47:22,710 --> 00:47:18,880

just like this and wind up on her

1097

00:47:24,710 --> 00:47:22,720

doorstep after a 100 million years tops

1098

00:47:26,390 --> 00:47:24,720

i know what you're thinking oh brenden

1099

00:47:28,390 --> 00:47:26,400

you're far too handsome to wait around

1100

00:47:30,309 --> 00:47:28,400

that long

1101

00:47:31,829 --> 00:47:30,319

you flatters no

1102

00:47:33,510 --> 00:47:31,839

i wasn't gonna plan to wait around that

1103

00:47:34,950 --> 00:47:33,520

long now they've had plenty of time to

1104

00:47:36,470 --> 00:47:34,960

show up already

1105

00:47:38,309 --> 00:47:36,480

why our earth has been around long

1106

00:47:40,710 --> 00:47:38,319

enough that if aliens arrived every

1107

00:47:44,069 --> 00:47:40,720

hundred million years we would have been

1108

00:47:45,910 --> 00:47:44,079

visited dozens of times by now

1109

00:47:47,349 --> 00:47:45,920

no aliens and

1110

00:47:49,349 --> 00:47:47,359

no sale for me

1111

00:47:51,270 --> 00:47:49,359

no no one has set foot anywhere near our

1112

00:47:53,670 --> 00:47:51,280

solar system despite what you might have

1113

00:47:55,270 --> 00:47:53,680

seen on the history channel

1114

00:47:57,829 --> 00:47:55,280

and we can't be the first civilization

1115

00:48:00,950 --> 00:47:57,839

either now over the last 13 billion

1116

00:48:03,829 --> 00:48:00,960

years more stars have formed in our

1117

00:48:05,589 --> 00:48:03,839

local cosmic neighborhood the milky way

1118

00:48:08,069 --> 00:48:05,599

than the total number of people who have

1119

00:48:10,390 --> 00:48:08,079

ever existed on our planet

1120

00:48:11,990 --> 00:48:10,400

even if just a millionth

1121

00:48:14,390 --> 00:48:12,000

of one percent

1122

00:48:16,710 --> 00:48:14,400

of those stars have had worlds around

1123

00:48:19,510 --> 00:48:16,720

them at one point like ours and could

1124

00:48:22,069 --> 00:48:19,520

support a civilization like ours

1125

00:48:23,750 --> 00:48:22,079

that's still over a thousand alien

1126  
00:48:25,589 --> 00:48:23,760  
species

1127  
00:48:27,990 --> 00:48:25,599  
and it only takes one

1128  
00:48:29,109 --> 00:48:28,000  
to conquer the stars

1129  
00:48:32,309 --> 00:48:29,119  
so

1130  
00:48:34,390 --> 00:48:32,319  
this should have been easy money

1131  
00:48:44,470 --> 00:48:34,400  
but where is everybody

1132  
00:48:48,870 --> 00:48:46,230  
thank you brendan that was wonderful i

1133  
00:48:50,230 --> 00:48:48,880  
really like your use of numbers my head

1134  
00:48:51,990 --> 00:48:50,240  
is spinning

1135  
00:48:53,589 --> 00:48:52,000  
but this is an important topic which

1136  
00:48:55,670 --> 00:48:53,599  
kate addressed in a very different way

1137  
00:48:57,990 --> 00:48:55,680  
from a different angle and i thank you

1138  
00:48:59,190 --> 00:48:58,000

for it

1139

00:49:00,069 --> 00:48:59,200

you know actually i'd like to hear you

1140

00:49:01,270 --> 00:49:00,079

explain something because i think it's

1141

00:49:03,109 --> 00:49:01,280

an interesting concept that i never

1142

00:49:04,549 --> 00:49:03,119

quite grasp when i when everybody talks

1143

00:49:06,549 --> 00:49:04,559

about well where are the aliens it's the

1144

00:49:08,470 --> 00:49:06,559

idea that well they may be out there but

1145

00:49:09,670 --> 00:49:08,480

our timeline may not

1146

00:49:10,790 --> 00:49:09,680

line up

1147

00:49:12,390 --> 00:49:10,800

that

1148

00:49:14,790 --> 00:49:12,400

you know the the

1149

00:49:16,710 --> 00:49:14,800

how am i describing this that that the

1150

00:49:17,589 --> 00:49:16,720

civilizations may be millions of years

1151

00:49:19,270 --> 00:49:17,599

off

1152

00:49:21,270 --> 00:49:19,280

that's true but if they're millions of

1153

00:49:22,870 --> 00:49:21,280

years off they'll have time to show up

1154

00:49:24,390 --> 00:49:22,880

here of course then that raises the

1155

00:49:26,390 --> 00:49:24,400

problem like you know

1156

00:49:28,549 --> 00:49:26,400

equivalently what kind of conversation

1157

00:49:31,190 --> 00:49:28,559

would we have with ants you know so

1158

00:49:33,430 --> 00:49:31,200

that's one possible solution to this but

1159

00:49:35,750 --> 00:49:33,440

i mean ultimately from the astrophysical

1160

00:49:37,829 --> 00:49:35,760

side of things which is what i study um

1161

00:49:39,990 --> 00:49:37,839

the universe ladies and gentlemen wants

1162

00:49:42,309 --> 00:49:40,000

to kill you but luckily for us it does a

1163

00:49:45,109 --> 00:49:42,319

really terrible job at it and it only

1164

00:49:47,349 --> 00:49:45,119

lobs something terrible at us every 50

1165

00:49:49,750 --> 00:49:47,359

or a couple hundred million years or so

1166

00:49:51,829 --> 00:49:49,760

things like asteroids wayward comets and

1167

00:49:53,990 --> 00:49:51,839

the occasional gamma-ray bursts stellar

1168

00:49:55,589 --> 00:49:54,000

explosion that beams its radiation in

1169

00:49:57,349 --> 00:49:55,599

our direction

1170

00:49:58,390 --> 00:49:57,359

so the idea here is that you know if

1171

00:50:00,470 --> 00:49:58,400

everyone

1172

00:50:01,910 --> 00:50:00,480

experiences these things then we should

1173

00:50:03,829 --> 00:50:01,920

all be about the same level and that's

1174

00:50:05,750 --> 00:50:03,839

one possible solution

1175

00:50:07,510 --> 00:50:05,760

so we could all be

1176

00:50:08,950 --> 00:50:07,520

all of our civilizations and our galaxy

1177

00:50:11,750 --> 00:50:08,960

could all just be staring out the night

1178

00:50:15,109 --> 00:50:11,760

sky being like hello where is everybody

1179

00:50:19,270 --> 00:50:17,270

so what is your favorite answer then to

1180

00:50:22,390 --> 00:50:19,280

this this question

1181

00:50:24,069 --> 00:50:22,400

i would say it's um 75 of what i just

1182

00:50:26,549 --> 00:50:24,079

said about all the universe trying to

1183

00:50:28,309 --> 00:50:26,559

kill you and all that and i would throw

1184

00:50:30,150 --> 00:50:28,319

in a little dash of

1185

00:50:31,190 --> 00:50:30,160

sustainability with that

1186

00:50:33,430 --> 00:50:31,200

because

1187

00:50:36,069 --> 00:50:33,440

you know it requires a lot of energy and

1188

00:50:38,150 --> 00:50:36,079

i think on the order of a gnp to

1189

00:50:40,230 --> 00:50:38,160

actually get the resources together to

1190

00:50:42,150 --> 00:50:40,240

shove some people off into space so i

1191

00:50:44,230 --> 00:50:42,160

mean we like to just look at pictures of

1192

00:50:47,750 --> 00:50:44,240

cats on the internet all day why doesn't

1193

00:50:47,760 --> 00:50:59,990

all right thank you

1194

00:51:04,230 --> 00:51:01,030

okay

1195

00:51:06,630 --> 00:51:04,240

i'm going to get this one right

1196

00:51:09,750 --> 00:51:06,640

our next speaker

1197

00:51:12,230 --> 00:51:09,760

is liz persec

1198

00:51:22,950 --> 00:51:13,190

yes

1199

00:51:29,670 --> 00:51:26,190

the earth is old really old

1200

00:51:31,589 --> 00:51:29,680

4.5 billion years old

1201  
00:51:34,950 --> 00:51:31,599  
now can you guys easily get your head

1202  
00:51:38,470 --> 00:51:34,960  
around exactly how long that is

1203  
00:51:40,309 --> 00:51:38,480  
i can't and i'm a geologist

1204  
00:51:42,790 --> 00:51:40,319  
the thing is though by understanding

1205  
00:51:45,670 --> 00:51:42,800  
these billions and billions of years

1206  
00:51:47,750 --> 00:51:45,680  
this deep time or geologic time

1207  
00:51:49,670 --> 00:51:47,760  
we get the sense of how the earth came

1208  
00:51:51,910 --> 00:51:49,680  
to be the way it is today

1209  
00:51:53,829 --> 00:51:51,920  
how life has been able to evolve and

1210  
00:51:56,230 --> 00:51:53,839  
thrive on this planet

1211  
00:51:59,190 --> 00:51:56,240  
so to demonstrate this i bet i brought

1212  
00:52:00,870 --> 00:51:59,200  
the best prop i could think of

1213  
00:52:03,190 --> 00:52:00,880

myself

1214

00:52:04,790 --> 00:52:03,200

you see i'm five foot ten inches tall

1215

00:52:06,950 --> 00:52:04,800

that means if we were to represent the

1216

00:52:10,069 --> 00:52:06,960

age of the earth in my height

1217

00:52:11,910 --> 00:52:10,079

one inch would be 65 million years that

1218

00:52:15,349 --> 00:52:11,920

means all the way down here at the soles

1219

00:52:17,589 --> 00:52:15,359

of my feet 4.5 billion years ago

1220

00:52:18,950 --> 00:52:17,599

the earth is forming from a planetary

1221

00:52:20,710 --> 00:52:18,960

nebula

1222

00:52:23,109 --> 00:52:20,720

we see the first life on earth about a

1223

00:52:25,510 --> 00:52:23,119

billion years later up here beneath my

1224

00:52:28,390 --> 00:52:25,520

knees these are single-celled

1225

00:52:29,510 --> 00:52:28,400

organisms called bacteria or germs as we

1226  
00:52:31,349 --> 00:52:29,520  
know them

1227  
00:52:33,349 --> 00:52:31,359  
and these are what i study

1228  
00:52:35,670 --> 00:52:33,359  
about a billion years later we see a

1229  
00:52:37,670 --> 00:52:35,680  
buildup of oxygen on the planet

1230  
00:52:39,910 --> 00:52:37,680  
the oxygen you and i breathe today is

1231  
00:52:41,750 --> 00:52:39,920  
thanks to these bacteria

1232  
00:52:43,510 --> 00:52:41,760  
that allowed for more advanced life

1233  
00:52:45,430 --> 00:52:43,520  
things like algae things called

1234  
00:52:47,430 --> 00:52:45,440  
eukaryotes to evolve

1235  
00:52:49,510 --> 00:52:47,440  
and those eukaryotes dominated the

1236  
00:52:51,829 --> 00:52:49,520  
planet to my chin

1237  
00:52:54,470 --> 00:52:51,839  
for billions of years all life on earth

1238  
00:52:56,470 --> 00:52:54,480

was too small to see with the naked eye

1239

00:52:59,030 --> 00:52:56,480

at my chin as we learned about earlier

1240

00:53:01,750 --> 00:52:59,040

you get an explosion of life things like

1241

00:53:04,470 --> 00:53:01,760

starfish and worms it my nose are the

1242

00:53:06,549 --> 00:53:04,480

earliest ancestors to the dinosaurs

1243

00:53:08,790 --> 00:53:06,559

which sadly die out about an inch from

1244

00:53:11,030 --> 00:53:08,800

the top of my head

1245

00:53:13,829 --> 00:53:11,040

so where does that leave us as humans

1246

00:53:16,069 --> 00:53:13,839

where do we fit in well using my time

1247

00:53:17,829 --> 00:53:16,079

scale our earliest ancestors which were

1248

00:53:19,109 --> 00:53:17,839

about half a million years ago they

1249

00:53:21,430 --> 00:53:19,119

diverged

1250

00:53:22,870 --> 00:53:21,440

you can summarize humanity as

1251

00:53:25,190 --> 00:53:22,880

a single hair

1252

00:53:27,030 --> 00:53:25,200

on the top of my head

1253

00:53:30,470 --> 00:53:27,040

so think about that next time you pull

1254

00:53:33,349 --> 00:53:30,480

that stray hair off your shirt

1255

00:53:36,630 --> 00:53:33,359

that flimsy hair represents all of

1256

00:53:40,950 --> 00:53:38,950

and that is why understanding geologic

1257

00:53:43,270 --> 00:53:40,960

time is so crucial

1258

00:53:45,349 --> 00:53:43,280

because by knowing how the planet came

1259

00:53:46,710 --> 00:53:45,359

to be the way it did today how we came

1260

00:53:49,430 --> 00:53:46,720

to be here

1261

00:53:50,790 --> 00:53:49,440

we know what to look for in the universe

1262

00:53:52,390 --> 00:53:50,800

and so i leave you with this thought

1263

00:53:55,030 --> 00:53:52,400

about the universe

1264

00:53:58,230 --> 00:53:55,040

it's about 14 billion years old or in my

1265

00:54:00,470 --> 00:53:58,240

time scale 18 feet tall

1266

00:54:02,309 --> 00:54:00,480

so i would be standing on the shoulders

1267

00:54:04,549 --> 00:54:02,319

of a liz who was standing on the

1268

00:54:07,190 --> 00:54:04,559

shoulders of another liz

1269

00:54:08,870 --> 00:54:07,200

so if life on earth began here and gave

1270

00:54:11,109 --> 00:54:08,880

us humans

1271

00:54:12,870 --> 00:54:11,119

what might life look like on a planet

1272

00:54:14,549 --> 00:54:12,880

where life began

1273

00:54:28,790 --> 00:54:14,559

eight feet

1274

00:54:33,270 --> 00:54:30,549

i like your big sigh of relief there at

1275

00:54:35,190 --> 00:54:33,280

the end there liz um you know i i i a

1276

00:54:36,549 --> 00:54:35,200

great comment you know one of the things

1277

00:54:39,190 --> 00:54:36,559

that in television that we do is we

1278

00:54:40,549 --> 00:54:39,200

reinterpret all the time and i think one

1279

00:54:41,750 --> 00:54:40,559

of the things you did really well is you

1280

00:54:43,750 --> 00:54:41,760

took a concept that we've seen

1281

00:54:45,829 --> 00:54:43,760

demonstrated other times before sagan

1282

00:54:47,030 --> 00:54:45,839

did it famously with the cosmic clock is

1283

00:54:47,750 --> 00:54:47,040

that what he called

1284

00:54:50,630 --> 00:54:47,760

and

1285

00:54:51,990 --> 00:54:50,640

by putting it in in terms of you you

1286

00:54:53,510 --> 00:54:52,000

reinterpret it for all of us so it's

1287

00:54:54,710 --> 00:54:53,520

always nice to see someone take

1288

00:54:56,549 --> 00:54:54,720

something that's been done before and do

1289

00:54:58,950 --> 00:54:56,559

it in a really good and new way so that

1290

00:55:01,190 --> 00:54:58,960

was great so thanks a lot and i did this

1291

00:55:03,750 --> 00:55:01,200

because i figured you guys all have the

1292

00:55:05,349 --> 00:55:03,760

same prop you can use

1293

00:55:07,109 --> 00:55:05,359

no this is key so when you're sitting on

1294

00:55:08,230 --> 00:55:07,119

the airplane flying back to wherever

1295

00:55:10,710 --> 00:55:08,240

you're from when i head back to

1296

00:55:11,510 --> 00:55:10,720

wisconsin go badgers

1297

00:55:13,510 --> 00:55:11,520

um

1298

00:55:14,549 --> 00:55:13,520

you guys can explain this and you can

1299

00:55:16,950 --> 00:55:14,559

say you know

1300

00:55:18,230 --> 00:55:16,960

we humans we're not everything we're one

1301

00:55:20,470 --> 00:55:18,240

hair

1302

00:55:21,910 --> 00:55:20,480

i think that's important

1303

00:55:23,349 --> 00:55:21,920

took the words out of my mouth liz i was

1304

00:55:26,069 --> 00:55:23,359

going to compliment you on a use of a

1305

00:55:28,870 --> 00:55:26,079

prop we all have i have the big chart on

1306

00:55:29,670 --> 00:55:28,880

my wall to show you know geologic time

1307

00:55:31,910 --> 00:55:29,680

but

1308

00:55:33,510 --> 00:55:31,920

using your body as your ruler is it's

1309

00:55:35,030 --> 00:55:33,520

much more meaningful i think thank you

1310

00:55:37,349 --> 00:55:35,040

very much

1311

00:55:40,309 --> 00:55:37,359

yeah that was really great um so so how

1312

00:55:42,390 --> 00:55:40,319

much um how much higher above your head

1313

00:55:45,190 --> 00:55:42,400

do you think life on earth might might

1314

00:55:50,950 --> 00:55:47,270

i would love to have another liz

1315

00:55:54,549 --> 00:55:52,549

i think that it's

1316

00:55:56,230 --> 00:55:54,559

a really good thing to keep into account

1317

00:55:58,150 --> 00:55:56,240

though and there was some talk earlier

1318

00:55:59,430 --> 00:55:58,160

just about sustainability and how we're

1319

00:56:01,910 --> 00:55:59,440

doing this and

1320

00:56:03,589 --> 00:56:01,920

by understanding that we're that hair it

1321

00:56:05,510 --> 00:56:03,599

really gives us a sense of what it might

1322

00:56:07,430 --> 00:56:05,520

take to even see

1323

00:56:09,109 --> 00:56:07,440

us survive another inch on top of my

1324

00:56:11,990 --> 00:56:09,119

head

1325

00:56:17,270 --> 00:56:12,000

i guess we will find out huh

1326

00:56:17,280 --> 00:56:21,430

thank you liz

1327

00:56:21,440 --> 00:56:24,150

wow

1328

00:56:24,160 --> 00:56:26,470

ah

1329

00:56:31,750 --> 00:56:30,390

i get to a second chance at this one

1330

00:56:36,870 --> 00:56:31,760

because i

1331

00:56:36,880 --> 00:56:43,030

au maui

1332

00:56:47,270 --> 00:56:45,349

gosh omawa

1333

00:56:48,789 --> 00:56:47,280

is an astronomer

1334

00:56:51,349 --> 00:56:48,799

and she's going to deliver a

1335

00:56:56,549 --> 00:56:51,359

presentation entitled

1336

00:56:56,559 --> 00:57:03,670

you go girl

1337

00:57:07,990 --> 00:57:06,789

14 years ago i left a career in

1338

00:57:10,069 --> 00:57:08,000

astronomy

1339

00:57:11,670 --> 00:57:10,079

because i thought there was only one way

1340

00:57:13,510 --> 00:57:11,680

to be a scientist

1341

00:57:17,190 --> 00:57:13,520

there was only one kind of person who

1342

00:57:19,670 --> 00:57:17,200

could be a scientist and it wasn't me

1343

00:57:21,190 --> 00:57:19,680

today i know there is not only one way

1344

00:57:23,030 --> 00:57:21,200

to be a scientist

1345

00:57:24,789 --> 00:57:23,040

just like as a researcher i've

1346

00:57:27,829 --> 00:57:24,799

discovered that ice

1347

00:57:30,150 --> 00:57:27,839

doesn't behave in only one way

1348

00:57:32,950 --> 00:57:30,160

say there's a planet orbiting the sun

1349

00:57:35,030 --> 00:57:32,960

with some bright white ice at the poles

1350

00:57:37,910 --> 00:57:35,040

most of the sun's light is light that we

1351  
00:57:40,230 --> 00:57:37,920  
can see with our eyes visible light

1352  
00:57:42,950 --> 00:57:40,240  
ice on that planet is going to act like

1353  
00:57:45,030 --> 00:57:42,960  
this white shirt and reflect most of the

1354  
00:57:47,349 --> 00:57:45,040  
visible light that hits it

1355  
00:57:49,349 --> 00:57:47,359  
if that ice could talk it would say

1356  
00:57:50,150 --> 00:57:49,359  
something like this to the sun's visible

1357  
00:57:52,829 --> 00:57:50,160  
light

1358  
00:57:56,069 --> 00:57:52,839  
okay thanks but like no

1359  
00:57:58,630 --> 00:57:56,079  
thanks like light is energy and energy

1360  
00:58:00,549 --> 00:57:58,640  
can heat so like i'm going to take a

1361  
00:58:01,829 --> 00:58:00,559  
little of your light and give you the

1362  
00:58:05,430 --> 00:58:01,839  
rest back

1363  
00:58:07,349 --> 00:58:05,440

like i don't want to melt i want to grow

1364

00:58:08,470 --> 00:58:07,359

and the more light that ice reflects

1365

00:58:10,950 --> 00:58:08,480

back to space

1366

00:58:13,990 --> 00:58:10,960

the less light it absorbs the colder the

1367

00:58:16,309 --> 00:58:14,000

planet gets the more ice forms

1368

00:58:18,230 --> 00:58:16,319

my research has shown that without any

1369

00:58:20,710 --> 00:58:18,240

greenhouse gases in the atmosphere to

1370

00:58:22,470 --> 00:58:20,720

keep the planet warm planets around

1371

00:58:23,270 --> 00:58:22,480

stars that are even brighter than the

1372

00:58:26,870 --> 00:58:23,280

sun

1373

00:58:29,109 --> 00:58:26,880

could become ice-covered snowballs

1374

00:58:31,510 --> 00:58:29,119

but see here's the thing ice doesn't

1375

00:58:33,910 --> 00:58:31,520

treat all types of light equally it

1376

00:58:35,910 --> 00:58:33,920

doesn't behave in only one way

1377

00:58:38,630 --> 00:58:35,920

let's take stars that are cooler than

1378

00:58:41,030 --> 00:58:38,640

the sun most of their light is infrared

1379

00:58:43,270 --> 00:58:41,040

light not visible light

1380

00:58:45,589 --> 00:58:43,280

ice on a planet orbiting a much cooler

1381

00:58:48,390 --> 00:58:45,599

star is going to act like these black

1382

00:58:50,470 --> 00:58:48,400

pants towards infrared light

1383

00:58:51,990 --> 00:58:50,480

if that ice could talk it would say

1384

00:58:54,710 --> 00:58:52,000

something a little different to its

1385

00:58:57,270 --> 00:58:54,720

stars infrared light it would say

1386

00:59:02,309 --> 00:58:57,280

come on in baby

1387

00:59:04,710 --> 00:59:02,319

i want you i need you i have to have you

1388

00:59:07,910 --> 00:59:04,720

don't worry baby i'm not gonna reject

1389

00:59:09,030 --> 00:59:07,920

you and reflect you i'm going to absorb

1390

00:59:15,349 --> 00:59:09,040

you

1391

00:59:17,990 --> 00:59:15,359

and the more light that ice absorbs the

1392

00:59:20,710 --> 00:59:18,000

warmer that planet gets remember light

1393

00:59:22,870 --> 00:59:20,720

is energy and energy heats the warmer

1394

00:59:24,309 --> 00:59:22,880

that planet gets what's going to happen

1395

00:59:26,069 --> 00:59:24,319

to that ice

1396

00:59:27,990 --> 00:59:26,079

it's going to melt

1397

00:59:30,549 --> 00:59:28,000

so what this means is that we may not

1398

00:59:33,589 --> 00:59:30,559

see much in the way of ice on planets

1399

00:59:35,670 --> 00:59:33,599

orbiting cooler stars and smaller cooler

1400

00:59:38,230 --> 00:59:35,680

stars are most of the stars in the

1401  
00:59:41,349 --> 00:59:38,240  
universe so our planet with its bright

1402  
00:59:43,270 --> 00:59:41,359  
polar caps could be pretty rare

1403  
00:59:45,829 --> 00:59:43,280  
but as i've found in my life there are

1404  
00:59:47,910 --> 00:59:45,839  
many ways to be a scientist so there are

1405  
00:59:51,510 --> 00:59:47,920  
likely many ways to make a

1406  
00:59:54,789 --> 00:59:51,520  
life-sustaining planet ice or no ice

1407  
00:59:56,950 --> 00:59:54,799  
in science and in life there are always

1408  
01:00:05,750 --> 00:59:56,960  
many possible ways

1409  
01:00:05,760 --> 01:00:09,510  
judges

1410  
01:00:12,470 --> 01:00:11,030  
that was great i think i think we're

1411  
01:00:14,069 --> 01:00:12,480  
seeing a theme here of people using

1412  
01:00:15,670 --> 01:00:14,079  
props that they don't have to carry on

1413  
01:00:18,230 --> 01:00:15,680

to stage exactly

1414

01:00:20,870 --> 01:00:18,240

so much easier in the suitcase yeah um

1415

01:00:22,710 --> 01:00:20,880

so that was a really neat way to to

1416

01:00:24,230 --> 01:00:22,720

illustrate illustrate your point i have

1417

01:00:27,510 --> 01:00:24,240

a question about the planets around

1418

01:00:30,150 --> 01:00:27,520

those um those red dwarf stars wouldn't

1419

01:00:32,710 --> 01:00:30,160

they just uh or wouldn't those

1420

01:00:33,910 --> 01:00:32,720

stars just have planets farther out that

1421

01:00:35,829 --> 01:00:33,920

had ice

1422

01:00:38,230 --> 01:00:35,839

farther away from the stars so yes if

1423

01:00:40,230 --> 01:00:38,240

you get farther and so i'm assuming that

1424

01:00:42,710 --> 01:00:40,240

all of these planets are at the same

1425

01:00:44,309 --> 01:00:42,720

dist at the same at the distance from

1426  
01:00:46,069 --> 01:00:44,319  
their star where they receive the same

1427  
01:00:47,910 --> 01:00:46,079  
amount of flux from their star that

1428  
01:00:49,190 --> 01:00:47,920  
earth receives from the sun so we're

1429  
01:00:50,950 --> 01:00:49,200  
putting them all at the place where

1430  
01:00:52,309 --> 01:00:50,960  
they're in their habitable zone where

1431  
01:00:54,789 --> 01:00:52,319  
liquid water

1432  
01:00:57,349 --> 01:00:54,799  
could exist but yes if you could kick a

1433  
01:01:00,069 --> 01:00:57,359  
planet far enough away so that that flux

1434  
01:01:03,030 --> 01:01:00,079  
is way way less than you could make ice

1435  
01:01:06,710 --> 01:01:04,950  
that was a lovely job

1436  
01:01:08,309 --> 01:01:06,720  
thank you very much and i wanted to

1437  
01:01:10,470 --> 01:01:08,319  
compliment you and take take the

1438  
01:01:12,230 --> 01:01:10,480

opportunity also to compliment everyone

1439

01:01:14,950 --> 01:01:12,240

thus far and i'm sure those who follow

1440

01:01:17,829 --> 01:01:14,960

you will do same to to use your body as

1441

01:01:19,589 --> 01:01:17,839

a prop and and to invite us all onto the

1442

01:01:22,230 --> 01:01:19,599

stage with you and get us to listen to

1443

01:01:24,390 --> 01:01:22,240

your talk about science by

1444

01:01:25,829 --> 01:01:24,400

just inviting us to look at you

1445

01:01:27,829 --> 01:01:25,839

and look at how comfortable you are and

1446

01:01:29,750 --> 01:01:27,839

how much fun you are and all of you have

1447

01:01:32,710 --> 01:01:29,760

done this and you've done it really well

1448

01:01:34,789 --> 01:01:32,720

i've seen all of you before if not live

1449

01:01:36,950 --> 01:01:34,799

at least in recording and that's so

1450

01:01:38,789 --> 01:01:36,960

important in communication it's a way of

1451  
01:01:40,630 --> 01:01:38,799  
making establishing a relationship with

1452  
01:01:42,309 --> 01:01:40,640  
your audience so you've done really well

1453  
01:01:43,750 --> 01:01:42,319  
there thank you

1454  
01:01:47,510 --> 01:01:43,760  
okay am i the only one in the room who

1455  
01:01:52,069 --> 01:01:50,390  
um no it's terrific um so question for

1456  
01:01:55,270 --> 01:01:52,079  
you back at the beginning you said you

1457  
01:01:57,510 --> 01:01:55,280  
left science for 14 years

1458  
01:01:59,910 --> 01:01:57,520  
what brought you back

1459  
01:02:01,910 --> 01:01:59,920  
i fell in love with astronomy again i

1460  
01:02:04,470 --> 01:02:01,920  
was tired of learning about the

1461  
01:02:07,589 --> 01:02:04,480  
astronomy breakthroughs on tv with

1462  
01:02:08,789 --> 01:02:07,599  
everyone else and i actually so i went

1463  
01:02:10,230 --> 01:02:08,799

away and i

1464

01:02:12,549 --> 01:02:10,240

studied acting

1465

01:02:14,470 --> 01:02:12,559

um and

1466

01:02:15,750 --> 01:02:14,480

was like pulling staples out of paper

1467

01:02:17,829 --> 01:02:15,760

for a living and thought you know i

1468

01:02:18,950 --> 01:02:17,839

think i have a planetary science degree

1469

01:02:21,750 --> 01:02:18,960

i could probably get a better job than

1470

01:02:23,349 --> 01:02:21,760

that um so i actually got a job at

1471

01:02:25,510 --> 01:02:23,359

caltech working for the spitzer space

1472

01:02:27,029 --> 01:02:25,520

telescope just as a help desk operator

1473

01:02:28,710 --> 01:02:27,039

answering questions about the spitzer

1474

01:02:30,710 --> 01:02:28,720

space telescope and then i started to go

1475

01:02:32,630 --> 01:02:30,720

to science talks again and found that i

1476

01:02:35,190 --> 01:02:32,640

was really attracted to talks about

1477

01:02:36,470 --> 01:02:35,200

extrasolar planets um and i would go to

1478

01:02:38,309 --> 01:02:36,480

more and more talks and get more and

1479

01:02:41,430 --> 01:02:38,319

more interested and so my my interest

1480

01:02:44,069 --> 01:02:41,440

got reignited um and i thought you know

1481

01:02:46,390 --> 01:02:44,079

i became willing to go back and and get

1482

01:02:48,150 --> 01:02:46,400

that phd and stay this time

1483

01:02:49,750 --> 01:02:48,160

well congratulations that's great thank

1484

01:03:02,069 --> 01:02:49,760

you so much

1485

01:03:08,470 --> 01:03:04,630

so much

1486

01:03:12,150 --> 01:03:08,480

everybody you're so great all of you

1487

01:03:14,710 --> 01:03:12,160

and here comes another one so great

1488

01:03:17,029 --> 01:03:14,720

rebecca turk macleod

1489

01:03:19,670 --> 01:03:17,039

to the stage please

1490

01:03:22,230 --> 01:03:19,680

she's a molecular biologist

1491

01:03:23,829 --> 01:03:22,240

and she's going to tell you about

1492

01:03:25,510 --> 01:03:23,839

the rna

1493

01:03:34,069 --> 01:03:25,520

world

1494

01:03:38,150 --> 01:03:35,990

how did life

1495

01:03:41,109 --> 01:03:38,160

begin

1496

01:03:43,670 --> 01:03:41,119

no seriously does anybody know

1497

01:03:45,349 --> 01:03:43,680

i don't know the answer to that question

1498

01:03:47,589 --> 01:03:45,359

but it's something i'm really interested

1499

01:03:50,789 --> 01:03:47,599

in and i do have some ideas about what i

1500

01:03:54,309 --> 01:03:50,799

think might have happened

1501  
01:03:57,430 --> 01:03:54,319  
and i think it's based on very simple

1502  
01:03:59,029 --> 01:03:57,440  
principles and very basic chemical

1503  
01:04:01,109 --> 01:03:59,039  
compounds

1504  
01:04:04,230 --> 01:04:01,119  
the the problem is

1505  
01:04:05,670 --> 01:04:04,240  
that life is so complex

1506  
01:04:07,190 --> 01:04:05,680  
it's hard to

1507  
01:04:09,430 --> 01:04:07,200  
imagine how it could have come about

1508  
01:04:10,630 --> 01:04:09,440  
because it's so complex cells are very

1509  
01:04:12,789 --> 01:04:10,640  
complex they're made up of all these

1510  
01:04:15,270 --> 01:04:12,799  
different bits and pieces right there's

1511  
01:04:17,829 --> 01:04:15,280  
dna which is which is so important it's

1512  
01:04:20,470 --> 01:04:17,839  
the instruction manual for the cell it

1513  
01:04:22,069 --> 01:04:20,480

it makes it so the cells can replicate

1514

01:04:23,990 --> 01:04:22,079

and you can make more cells so that's

1515

01:04:26,630 --> 01:04:24,000

very important on the other hand we have

1516

01:04:28,069 --> 01:04:26,640

proteins proteins are the workhorses of

1517

01:04:30,390 --> 01:04:28,079

the cell they

1518

01:04:31,990 --> 01:04:30,400

they catalyze reactions which just means

1519

01:04:33,029 --> 01:04:32,000

that they make things happen more

1520

01:04:35,910 --> 01:04:33,039

quickly than they would if they were

1521

01:04:38,309 --> 01:04:35,920

just floating around

1522

01:04:40,630 --> 01:04:38,319

now wouldn't it be cool if there is one

1523

01:04:41,910 --> 01:04:40,640

kind of molecule that could do both

1524

01:04:43,670 --> 01:04:41,920

those things

1525

01:04:46,069 --> 01:04:43,680

it turns out there is

1526

01:04:48,549 --> 01:04:46,079

and it's called rna

1527

01:04:51,510 --> 01:04:48,559

and rna as you might guess from its name

1528

01:04:52,789 --> 01:04:51,520

is kind of similar to dna

1529

01:04:57,670 --> 01:04:52,799

it's kind of like this piece of paper

1530

01:05:03,349 --> 01:05:00,309

but it also does something really cool

1531

01:05:05,750 --> 01:05:03,359

and that it folds itself

1532

01:05:08,470 --> 01:05:05,760

and forms structures

1533

01:05:10,549 --> 01:05:08,480

like this little bunny rabbit

1534

01:05:12,470 --> 01:05:10,559

and these structures can carry out

1535

01:05:18,470 --> 01:05:12,480

functions

1536

01:05:20,309 --> 01:05:18,480

now i'm not trying to say that rna is a

1537

01:05:22,549 --> 01:05:20,319

bunny rabbit or the the first life

1538

01:05:24,870 --> 01:05:22,559

looked like a bunny rabbit

1539

01:05:27,270 --> 01:05:24,880

what i'm trying to say is that now that

1540

01:05:28,309 --> 01:05:27,280

we know this it's not that hard to

1541

01:05:30,150 --> 01:05:28,319

envision

1542

01:05:32,710 --> 01:05:30,160

an rna world

1543

01:05:35,349 --> 01:05:32,720

in which all of the functions of life

1544

01:05:37,270 --> 01:05:35,359

were carried out by one kind of molecule

1545

01:05:38,710 --> 01:05:37,280

not all kinds all different kinds of

1546

01:05:41,270 --> 01:05:38,720

molecules

1547

01:05:42,630 --> 01:05:41,280

and if we can envision that happening

1548

01:05:43,670 --> 01:05:42,640

on earth

1549

01:05:48,309 --> 01:05:43,680

maybe

1550

01:05:57,589 --> 01:05:48,319

on other worlds right now

1551  
01:06:01,990 --> 01:05:59,270  
thank you rebecca that was really good

1552  
01:06:04,549 --> 01:06:02,000  
and i particularly appreciate your prop

1553  
01:06:06,309 --> 01:06:04,559  
to illustrate that structure can perform

1554  
01:06:09,670 --> 01:06:06,319  
function that was very nice i appreciate

1555  
01:06:13,029 --> 01:06:11,190  
so um

1556  
01:06:16,069 --> 01:06:13,039  
it's it's a really cool idea about the

1557  
01:06:18,069 --> 01:06:16,079  
origin of life how how could you test it

1558  
01:06:20,950 --> 01:06:18,079  
well we we have done a lot of work to

1559  
01:06:24,309 --> 01:06:20,960  
test uh what are the capabilities of rna

1560  
01:06:25,829 --> 01:06:24,319  
what kinds of reactions can it catalyze

1561  
01:06:28,549 --> 01:06:25,839  
and actually something that i've worked

1562  
01:06:30,309 --> 01:06:28,559  
on is um how did the first proteins then

1563  
01:06:32,309 --> 01:06:30,319

come about you know after that happen

1564

01:06:35,029 --> 01:06:32,319

because obviously we needed proteins and

1565

01:06:37,029 --> 01:06:35,039

it turns out that rna can actually do

1566

01:06:39,510 --> 01:06:37,039

all of the reactions that are necessary

1567

01:06:41,510 --> 01:06:39,520

to form proteins all by itself in kind

1568

01:06:43,349 --> 01:06:41,520

of different bits and what i'd actually

1569

01:06:45,670 --> 01:06:43,359

really like to do someday is have kind

1570

01:06:47,270 --> 01:06:45,680

of an rna party and a test tube and see

1571

01:06:50,870 --> 01:06:47,280

if we can actually start you know making

1572

01:06:52,470 --> 01:06:50,880

proteins just with rna

1573

01:06:53,910 --> 01:06:52,480

i i think i don't have anything now i

1574

01:06:56,230 --> 01:06:53,920

think that was really terrific i love i

1575

01:06:57,510 --> 01:06:56,240

love anytime somebody can can do origami

1576

01:06:58,789 --> 01:06:57,520

on stage

1577

01:07:09,349 --> 01:06:58,799

it's all good

1578

01:07:09,359 --> 01:07:12,309

wow

1579

01:07:12,319 --> 01:07:19,029

i'm glad uhura took up communications

1580

01:07:19,039 --> 01:07:26,150

thank you thank you so much

1581

01:07:38,630 --> 01:07:27,910

okay i'm i

1582

01:07:44,630 --> 01:07:39,510

yeah

1583

01:07:44,640 --> 01:07:48,950

studies planetary protection

1584

01:07:54,069 --> 01:07:50,630

after all that's been on there i think

1585

01:07:59,750 --> 01:07:57,349

planetary protection

1586

01:08:01,589 --> 01:07:59,760

he's going to come up and talk about the

1587

01:08:04,069 --> 01:08:01,599

true nature

1588

01:08:14,309 --> 01:08:04,079

of self

1589

01:08:18,470 --> 01:08:16,630

we as a human being take an extreme

1590

01:08:20,309 --> 01:08:18,480

pride in ourselves

1591

01:08:22,550 --> 01:08:20,319

as highly evolved and intelligent

1592

01:08:24,709 --> 01:08:22,560

species on this planet

1593

01:08:27,110 --> 01:08:24,719

but i want to find out what is the true

1594

01:08:29,990 --> 01:08:27,120

nature of self because all our research

1595

01:08:32,789 --> 01:08:30,000

our understanding our findings

1596

01:08:34,229 --> 01:08:32,799

are centric to this self identity or our

1597

01:08:36,149 --> 01:08:34,239

self

1598

01:08:39,110 --> 01:08:36,159

to find out that we have to take a small

1599

01:08:41,590 --> 01:08:39,120

journey a very short journey to the end

1600

01:08:44,070 --> 01:08:41,600

of this known universe

1601  
01:08:46,950 --> 01:08:44,080  
and we're going to borrow the spaceship

1602  
01:08:48,789 --> 01:08:46,960  
from michelle can we

1603  
01:08:50,950 --> 01:08:48,799  
and then we'll start our journey with

1604  
01:08:53,590 --> 01:08:50,960  
the speed of light and we're going to

1605  
01:08:55,269 --> 01:08:53,600  
move start moving from our this own

1606  
01:08:58,470 --> 01:08:55,279  
planet

1607  
01:09:01,030 --> 01:08:58,480  
within 5 hours and 15 minutes

1608  
01:09:03,590 --> 01:09:01,040  
will be the end of our last planet on

1609  
01:09:05,749 --> 01:09:03,600  
this pluto

1610  
01:09:06,950 --> 01:09:05,759  
sorry pluto is not anymore a planet

1611  
01:09:08,789 --> 01:09:06,960  
right

1612  
01:09:11,189 --> 01:09:08,799  
damn

1613  
01:09:12,070 --> 01:09:11,199

well we'll get over it mr tyson that's

1614

01:09:13,510 --> 01:09:12,080

fine

1615

01:09:15,590 --> 01:09:13,520

we got we're not going to stop there

1616

01:09:18,470 --> 01:09:15,600

anyway we'll continue our journey

1617

01:09:20,470 --> 01:09:18,480

perpendicular and keep moving

1618

01:09:22,470 --> 01:09:20,480

all the stars disappear

1619

01:09:26,470 --> 01:09:22,480

and keep moving

1620

01:09:29,910 --> 01:09:26,480

within 5 000 years we cross the closest

1621

01:09:31,669 --> 01:09:29,920

sun alpha century to our solar system

1622

01:09:35,030 --> 01:09:31,679

but we're not going to stop there too

1623

01:09:37,590 --> 01:09:35,040

we'll keep moving and it's not till 100

1624

01:09:40,070 --> 01:09:37,600

000 light years we pass and we can see

1625

01:09:42,149 --> 01:09:40,080

the spiral structure of our own galaxy

1626

01:09:44,229 --> 01:09:42,159

our milky way

1627

01:09:46,390 --> 01:09:44,239

we're not going to stop there either

1628

01:09:49,829 --> 01:09:46,400

if we keep moving

1629

01:09:52,870 --> 01:09:49,839

every moving star is no more a star it's

1630

01:09:55,110 --> 01:09:52,880

an entire galaxy comprised of billions

1631

01:09:57,189 --> 01:09:55,120

and billions of stars within it

1632

01:09:58,790 --> 01:09:57,199

and more complex and diverse than each

1633

01:10:01,030 --> 01:09:58,800

other

1634

01:10:02,870 --> 01:10:01,040

one billion year

1635

01:10:05,510 --> 01:10:02,880

5 billion years

1636

01:10:07,110 --> 01:10:05,520

and after 10 billion years

1637

01:10:09,430 --> 01:10:07,120

we will stop

1638

01:10:11,510 --> 01:10:09,440

i mean look back where we started

1639

01:10:16,709 --> 01:10:11,520

and when i look back i could see the

1640

01:10:19,990 --> 01:10:16,719

extreme tapestry of this known cosmos

1641

01:10:22,709 --> 01:10:20,000

if i look back and i feel small and

1642

01:10:24,149 --> 01:10:22,719

short there is something wrong with me

1643

01:10:26,950 --> 01:10:24,159

i don't feel like that

1644

01:10:28,310 --> 01:10:26,960

because every carbon nitrogen and oxygen

1645

01:10:29,830 --> 01:10:28,320

in my body

1646

01:10:32,630 --> 01:10:29,840

was born somewhere out there in those

1647

01:10:34,390 --> 01:10:32,640

distance galaxies and it's within me

1648

01:10:38,229 --> 01:10:34,400

i feel great

1649

01:10:40,470 --> 01:10:38,239

hindus call it as advaita or non-duality

1650

01:10:42,830 --> 01:10:40,480

some call it as singularity and some

1651

01:10:45,590 --> 01:10:42,840

call it as cosmic

1652

01:10:49,430 --> 01:10:45,600

kinship carl sagan understood that and

1653

01:10:51,990 --> 01:10:49,440

that's why he said we are star stuff

1654

01:10:52,950 --> 01:10:52,000

and if we understand this true nature of

1655

01:10:54,310 --> 01:10:52,960

self

1656

01:10:56,229 --> 01:10:54,320

we can do

1657

01:10:58,149 --> 01:10:56,239

lot of good discoveries

1658

01:11:00,310 --> 01:10:58,159

and this is why i want to pass this

1659

01:11:02,950 --> 01:11:00,320

message and leave you with this thought

1660

01:11:04,149 --> 01:11:02,960

but tonight when you go to bed at least

1661

01:11:06,390 --> 01:11:04,159

think once

1662

01:11:12,630 --> 01:11:06,400

what is true nature of self

1663

01:11:12,640 --> 01:11:16,630

judges

1664

01:11:20,630 --> 01:11:18,950

that was uh really lovely and inspiring

1665

01:11:24,870 --> 01:11:20,640

and i liked how you worked the phrase

1666

01:11:29,669 --> 01:11:27,270

thank you parag that was lovely and i

1667

01:11:32,630 --> 01:11:29,679

think it's it's an important concept for

1668

01:11:35,430 --> 01:11:32,640

us to discuss particularly with our

1669

01:11:37,110 --> 01:11:35,440

non-experts in our communities uh that

1670

01:11:38,790 --> 01:11:37,120

we are all

1671

01:11:42,709 --> 01:11:38,800

part of the universe we all live in the

1672

01:11:45,910 --> 01:11:44,229

you've made me feel so much better

1673

01:11:47,030 --> 01:11:45,920

tonight

1674

01:11:49,030 --> 01:11:47,040

um you know i think one of the things

1675

01:11:51,189 --> 01:11:49,040

that you've done is something that that

1676

01:11:53,189 --> 01:11:51,199

that other people have done here and

1677

01:11:54,790 --> 01:11:53,199

you've each done it in a really unique

1678

01:11:56,630 --> 01:11:54,800

way which is to

1679

01:12:00,229 --> 01:11:56,640

express scale

1680

01:12:01,910 --> 01:12:00,239

in in a very different way um you know

1681

01:12:04,070 --> 01:12:01,920

one did it through height you've done it

1682

01:12:04,950 --> 01:12:04,080

through speed i i think that's that's

1683

01:12:05,830 --> 01:12:04,960

admirable because i think one of the

1684

01:12:08,310 --> 01:12:05,840

things

1685

01:12:10,950 --> 01:12:08,320

especially layman like myself fail to

1686

01:12:13,110 --> 01:12:10,960

understand often is is scope

1687

01:12:14,630 --> 01:12:13,120

of science and i think you did a great

1688

01:12:16,390 --> 01:12:14,640

job in that i have to ask you because we

1689

01:12:18,229 --> 01:12:16,400

have a little bit of time left something

1690

01:12:19,350 --> 01:12:18,239

has nothing to do with your talk but has

1691

01:12:21,189 --> 01:12:19,360

everything to do with what you study

1692

01:12:23,189 --> 01:12:21,199

which is planetary protection which is

1693

01:12:25,750 --> 01:12:23,199

just the coolest thing in the world

1694

01:12:27,350 --> 01:12:25,760

um so what's the what's the

1695

01:12:29,510 --> 01:12:27,360

what's the thing that the planetary

1696

01:12:30,390 --> 01:12:29,520

protection people worry about the most

1697

01:12:32,950 --> 01:12:30,400

sure

1698

01:12:35,110 --> 01:12:32,960

so planetary protection has two meaning

1699

01:12:37,189 --> 01:12:35,120

i mean two things to worry about one is

1700

01:12:39,510 --> 01:12:37,199

a forward contamination that means you

1701

01:12:41,590 --> 01:12:39,520

don't want to carry any bugs

1702

01:12:43,590 --> 01:12:41,600

with you on the spacecraft to other

1703

01:12:46,070 --> 01:12:43,600

planets and you don't want to bring any

1704

01:12:47,590 --> 01:12:46,080

bugs back which we haven't done yet but

1705

01:12:50,390 --> 01:12:47,600

we don't want to bring anything back

1706

01:12:52,550 --> 01:12:50,400

from other planets to this our own

1707

01:12:53,510 --> 01:12:52,560

planet so we make sure that we are not

1708

01:12:56,790 --> 01:12:53,520

carrying

1709

01:12:58,709 --> 01:12:56,800

uh microbes with us on the other planet

1710

01:13:00,229 --> 01:12:58,719

being said that we cannot completely

1711

01:13:02,630 --> 01:13:00,239

sterilize the spacecraft but we make

1712

01:13:03,830 --> 01:13:02,640

sure that it's below a certain threshold

1713

01:13:05,350 --> 01:13:03,840

that is not going to contaminate the

1714

01:13:08,709 --> 01:13:05,360

other planets

1715

01:13:10,470 --> 01:13:08,719

i feel safer now so thank you

1716

01:13:16,070 --> 01:13:10,480

thank you

1717

01:13:22,790 --> 01:13:19,110

so i'm star stuff

1718

01:13:26,390 --> 01:13:24,550

where do we go from here

1719

01:13:30,470 --> 01:13:26,400

is that the end

1720

01:13:33,990 --> 01:13:31,590

aha

1721

01:13:36,070 --> 01:13:34,000

i guess i'll put my eyeglasses on i knew

1722

01:13:40,390 --> 01:13:36,080

you were there all the time

1723

01:13:44,390 --> 01:13:42,310

finally we're going to see nicole

1724

01:13:51,430 --> 01:13:44,400

younger

1725

01:13:54,390 --> 01:13:51,440

she's a physicist and she's going to

1726

01:13:56,790 --> 01:13:54,400

deliver presentation entitled

1727

01:13:58,870 --> 01:13:56,800

i love the smell of evolution in the

1728

01:14:10,229 --> 01:13:58,880

morning

1729

01:14:14,709 --> 01:14:11,750

life is like

1730

01:14:16,790 --> 01:14:14,719

a garbage dump

1731

01:14:19,669 --> 01:14:16,800

never mind when you hear about boxes of

1732

01:14:22,470 --> 01:14:19,679

chocolates living systems are organized

1733

01:14:24,709 --> 01:14:22,480

like dumps by thinking about a dump we

1734

01:14:26,550 --> 01:14:24,719

can understand why life can evolve why

1735

01:14:30,470 --> 01:14:26,560

we can exist

1736

01:14:36,950 --> 01:14:30,480

picture a dump see the rusty bicycles

1737

01:14:44,070 --> 01:14:40,229

let's give our dump a stench rating

1738

01:14:46,550 --> 01:14:44,080

if the old meatloaf mixes with car oil

1739

01:14:47,830 --> 01:14:46,560

the smell knocks us out and has a rating

1740

01:14:51,030 --> 01:14:47,840

of ten

1741

01:14:53,590 --> 01:14:51,040

if food occupies one bin meddles another

1742

01:14:56,470 --> 01:14:53,600

and so on the smell just turns us pale

1743

01:14:59,350 --> 01:14:56,480

green and has a rating of one

1744

01:15:02,070 --> 01:14:59,360

now picture a primordial soup

1745

01:15:03,590 --> 01:15:02,080

carbon atoms mix with hydrogen oxygen

1746

01:15:06,470 --> 01:15:03,600

and other atoms

1747

01:15:09,669 --> 01:15:06,480

carbon atoms are like milk cartons

1748

01:15:12,630 --> 01:15:09,679

hydrogen is like hamster droppings the

1749

01:15:14,630 --> 01:15:12,640

primordial soup is like a dump where the

1750

01:15:17,030 --> 01:15:14,640

trash mixes

1751

01:15:18,149 --> 01:15:17,040

primordial soups have high stench

1752

01:15:20,390 --> 01:15:18,159

readings

1753

01:15:22,950 --> 01:15:20,400

stench doesn't sound scientific

1754

01:15:25,350 --> 01:15:22,960

physicists say entropy

1755

01:15:27,030 --> 01:15:25,360

primordial soups have high entropy

1756

01:15:29,750 --> 01:15:27,040

they're disordered

1757

01:15:32,070 --> 01:15:29,760

organisms have low entropy

1758

01:15:34,070 --> 01:15:32,080

the atoms in us are organized into

1759

01:15:36,790 --> 01:15:34,080

molecules and cells

1760

01:15:38,870 --> 01:15:36,800

a cell is like a bin in the dump

1761

01:15:41,750 --> 01:15:38,880

dumps that have bins have low stench

1762

01:15:43,830 --> 01:15:41,760

ratings organisms that have cells have

1763

01:15:47,189 --> 01:15:43,840

low entropy

1764

01:15:49,510 --> 01:15:47,199

how can a high entropy disordered

1765

01:15:53,110 --> 01:15:49,520

primordial soup evolve into a low

1766

01:15:55,430 --> 01:15:53,120

entropy ordered organism a physical law

1767

01:15:56,790 --> 01:15:55,440

says that many systems become more

1768

01:15:59,430 --> 01:15:56,800

disordered

1769

01:16:01,669 --> 01:15:59,440

if we throw more trash in the dump the

1770

01:16:03,350 --> 01:16:01,679

smell won't improve

1771

01:16:04,709 --> 01:16:03,360

right

1772

01:16:07,990 --> 01:16:04,719

wrong

1773

01:16:09,990 --> 01:16:08,000

if we put clothes pins on our noses and

1774

01:16:15,030 --> 01:16:10,000

organize the dump

1775

01:16:17,669 --> 01:16:15,040

dirty our clothes if we pollute while

1776

01:16:20,470 --> 01:16:17,679

driving to the dump if we create more

1777

01:16:21,430 --> 01:16:20,480

disorder outside the dump than order in

1778

01:16:24,550 --> 01:16:21,440

it

1779

01:16:27,189 --> 01:16:24,560

similarly as life has evolved on earth

1780

01:16:29,590 --> 01:16:27,199

the earth has radiated we've polluted

1781

01:16:32,149 --> 01:16:29,600

outer space with energy

1782

01:16:35,590 --> 01:16:32,159

evolution creates more disorder outside

1783

01:16:38,709 --> 01:16:35,600

living systems than order in them

1784

01:16:39,830 --> 01:16:38,719

evolution can enable organized life to

1785

01:16:40,709 --> 01:16:39,840

form

1786

01:16:43,110 --> 01:16:40,719

we

1787

01:16:45,910 --> 01:16:43,120

can exist

1788

01:16:46,830 --> 01:16:45,920

and life is like a garbage dump

1789

01:16:48,550 --> 01:16:46,840

we

1790

01:17:03,669 --> 01:16:48,560

smell

1791

01:17:07,030 --> 01:17:05,750

judges

1792

01:17:09,189 --> 01:17:07,040

nicole i remember

1793

01:17:11,189 --> 01:17:09,199

seeing you in dc and and

1794

01:17:13,590 --> 01:17:11,199

and wondering how you can keep up such

1795

01:17:15,669 --> 01:17:13,600

energy uh it's amazing and especially

1796

01:17:18,870 --> 01:17:15,679

given the fact it's not easy to go to go

1797

01:17:20,470 --> 01:17:18,880

last um so it's really it's great and

1798

01:17:24,709 --> 01:17:20,480

and i think one of the things you've

1799

01:17:27,030 --> 01:17:24,719

done really well is you've painted a

1800

01:17:29,750 --> 01:17:27,040

a picture a visual or i guess this time

1801

01:17:31,830 --> 01:17:29,760

an olfactory

1802

01:17:33,430 --> 01:17:31,840

picture in all of our heads and i think

1803

01:17:35,270 --> 01:17:33,440

a great science communicator great

1804

01:17:37,189 --> 01:17:35,280

communicator has to be able to paint a

1805

01:17:40,310 --> 01:17:37,199

great picture and drag the audience

1806

01:17:41,990 --> 01:17:40,320

along so great job on that

1807

01:17:43,430 --> 01:17:42,000

thank you nicole that was wonderful and

1808

01:17:44,950 --> 01:17:43,440

when you're rich and famous your

1809

01:17:48,790 --> 01:17:44,960

signature perfume will be called

1810

01:17:52,709 --> 01:17:50,470

and i'm going to take this opportunity

1811

01:17:54,709 --> 01:17:52,719

because we won't have an opportunity to

1812

01:17:57,189 --> 01:17:54,719

speak with all the contestants once we

1813

01:17:59,750 --> 01:17:57,199

go into our chambers but i've seen you

1814

01:18:01,910 --> 01:17:59,760

all either live or recorded and you've

1815

01:18:03,270 --> 01:18:01,920

all gotten better you've all gained more

1816

01:18:04,950 --> 01:18:03,280

confidence you all came into this

1817

01:18:06,550 --> 01:18:04,960

competition with a lot of confidence it

1818

01:18:08,870 --> 01:18:06,560

takes a lot of confidence to get up

1819

01:18:10,790 --> 01:18:08,880

there in front of strangers and and do

1820

01:18:12,550 --> 01:18:10,800

your thing you've gotten better at it

1821

01:18:14,229 --> 01:18:12,560

you're more comfortable and all of you

1822

01:18:16,070 --> 01:18:14,239

who competed

1823

01:18:18,709 --> 01:18:16,080

and have not gone up on stage tonight

1824

01:18:20,310 --> 01:18:18,719

i'm sure you're all getting better

1825

01:18:24,149 --> 01:18:20,320

and the learning curve has been

1826

01:18:26,070 --> 01:18:24,159

wonderful to observe so thank you all

1827

01:18:29,030 --> 01:18:26,080

i can pre i completely agree with what

1828

01:18:29,830 --> 01:18:29,040

uh linda said uh you're you're all just

1829

01:18:30,630 --> 01:18:29,840

uh

1830

01:18:32,870 --> 01:18:30,640

so

1831

01:18:35,189 --> 01:18:32,880

wonderful you uh have all blown us away

1832

01:18:37,510 --> 01:18:35,199

and your energy is terrific especially

1833

01:18:41,030 --> 01:18:37,520

in in a large room like this it it's

1834

01:18:42,390 --> 01:18:41,040

just wonderful you you fill the hall um

1835

01:18:44,709 --> 01:18:42,400

quick question since i'm the one with

1836

01:18:48,870 --> 01:18:44,719

the annoying nerdy questions because

1837

01:18:52,950 --> 01:18:50,149

that

1838

01:18:55,189 --> 01:18:52,960

you're saying stuff with high entropy

1839

01:18:57,350 --> 01:18:55,199

is stinky and i feel like there's

1840

01:18:58,550 --> 01:18:57,360

something really profound there but i'm

1841

01:19:03,030 --> 01:18:58,560

not sure why

1842

01:19:05,110 --> 01:19:03,040

why do high entropy things smell

1843

01:19:08,870 --> 01:19:05,120

just to be certain

1844

01:19:11,350 --> 01:19:08,880

the smell is part of the analogy

1845

01:19:15,750 --> 01:19:11,360

i'm not saying that we smell i trust you

1846

01:19:20,550 --> 01:19:18,070

what i'm trying to say is that

1847

01:19:23,110 --> 01:19:20,560

many physicists like to explain entropy

1848

01:19:25,189 --> 01:19:23,120

in terms of disorder

1849

01:19:27,990 --> 01:19:25,199

something that is a high entropy system

1850

01:19:30,470 --> 01:19:28,000

is like a disordered garbage dump and

1851

01:19:33,030 --> 01:19:30,480

just like a disordered garbage dump has

1852

01:19:35,030 --> 01:19:33,040

a high stench rating

1853

01:19:36,470 --> 01:19:35,040

a high entropy

1854

01:19:38,630 --> 01:19:36,480

organic system

1855

01:19:41,110 --> 01:19:38,640

has high entropy

1856

01:19:43,750 --> 01:19:41,120

a sort of disordered

1857

01:19:45,590 --> 01:19:43,760

organic system has high entropy so i'm

1858

01:20:04,070 --> 01:19:45,600

saying that the stench is like the

1859

01:20:09,910 --> 01:20:08,229

i didn't know that i was so complex

1860

01:20:12,790 --> 01:20:09,920

and beautiful

1861

01:20:15,830 --> 01:20:12,800

until i heard all of you

1862

01:20:18,229 --> 01:20:15,840

and now i'm going home on a high energy

1863

01:20:20,149 --> 01:20:18,239

level i thank you all you're just

1864

01:20:21,750 --> 01:20:20,159

incredible

1865

01:20:25,110 --> 01:20:21,760

judges

1866

01:20:27,830 --> 01:20:25,120

you've got your work cut out for you

1867

01:20:32,310 --> 01:20:27,840

and i don't envy you

1868

01:20:35,189 --> 01:20:33,430

um

1869

01:20:37,750 --> 01:20:35,199

that ends

1870

01:20:39,430 --> 01:20:37,760

the competition and the judges are going

1871

01:20:41,910 --> 01:20:39,440

to retire to

1872

01:20:46,550 --> 01:20:41,920

commissary

1873

01:20:48,950 --> 01:20:47,990

so i know what you're all thinking

1874

01:20:51,590 --> 01:20:48,960

you're all thinking that they have a

1875

01:20:53,350 --> 01:20:51,600

really tough job to do right

1876

01:20:56,310 --> 01:20:53,360

how about a big handful yeah

1877

01:20:56,320 --> 01:21:01,590

judges thank you

1878

01:21:04,470 --> 01:21:02,870

so you might be thinking that they've

1879

01:21:06,629 --> 01:21:04,480

got a really tough job but you've got

1880

01:21:08,149 --> 01:21:06,639

the same job there are note cards that

1881

01:21:10,870 --> 01:21:08,159

we left on your chairs you came in and

1882

01:21:11,830 --> 01:21:10,880

little golf pencils you got to vote okay

1883

01:21:14,550 --> 01:21:11,840

we're going to do a people's choice

1884

01:21:16,070 --> 01:21:14,560

award for one of these 11 contestants so

1885

01:21:17,030 --> 01:21:16,080

fill them out hand them to the aisles

1886

01:21:19,030 --> 01:21:17,040

we're going to volunteers come and

1887

01:21:20,550 --> 01:21:19,040

collect them and while you're doing that

1888

01:21:22,149 --> 01:21:20,560

i'm going to invite up the director of

1889

01:21:24,550 --> 01:21:22,159

development for the cheltenham science

1890

01:21:25,669 --> 01:21:24,560

festival's stephen burgess and steve is

1891

01:21:28,310 --> 01:21:25,679

going to talk to you a little bit about

1892

01:21:30,629 --> 01:21:28,320

the history of fame lab so please

1893

01:21:32,470 --> 01:21:30,639

welcome steve to the stage and continue

1894

01:21:34,310 --> 01:21:32,480

to vote on your favorite choice can we

1895

01:21:36,950 --> 01:21:34,320

do this ladies and gentlemen before you

1896

01:21:40,149 --> 01:21:36,960

leave can we get our ten contestants to

1897

01:22:01,110 --> 01:21:40,159

stand and turn around because each one

1898

01:22:01,120 --> 01:22:08,629

all right but you can only pick one

1899

01:22:13,350 --> 01:22:11,270

no thank you sean

1900

01:22:15,350 --> 01:22:13,360

while you're all uh making your hard

1901

01:22:18,229 --> 01:22:15,360

choices i'll give you a little bit of a

1902

01:22:20,229 --> 01:22:18,239

history of uh a fame lab but first you

1903

01:22:23,030 --> 01:22:20,239

know i would like to thank sean and the

1904

01:22:25,590 --> 01:22:23,040

other teams at uh at nasa

1905

01:22:27,030 --> 01:22:25,600

uh without their uh incredible energy

1906

01:22:29,510 --> 01:22:27,040

and commitment we would have never got

1907

01:22:31,270 --> 01:22:29,520

this far in such a short amount of time

1908

01:22:32,470 --> 01:22:31,280

to put something together in less than

1909

01:22:33,910 --> 01:22:32,480

six months

1910

01:22:35,669 --> 01:22:33,920

having been through many fame lab

1911

01:22:37,910 --> 01:22:35,679

competitions elsewhere in the world is

1912

01:22:39,430 --> 01:22:37,920

remarkable and it is down really to the

1913

01:22:43,189 --> 01:22:39,440

energy of the three

1914

01:22:47,750 --> 01:22:46,070

fame lab was started uh in the uk in

1915

01:22:48,629 --> 01:22:47,760

2005

1916

01:22:50,470 --> 01:22:48,639

so

1917

01:22:51,590 --> 01:22:50,480

it's not exactly out of the primordial

1918

01:22:52,390 --> 01:22:51,600

soup

1919

01:22:54,709 --> 01:22:52,400

in here

1920

01:22:58,470 --> 01:22:54,719

relatively young

1921

01:23:00,470 --> 01:22:58,480

and it was started for one reason only

1922

01:23:01,590 --> 01:23:00,480

at that point and that was to find new

1923

01:23:03,189 --> 01:23:01,600

talent

1924

01:23:04,629 --> 01:23:03,199

to feed into the cheltenham science

1925

01:23:06,390 --> 01:23:04,639

festival

1926

01:23:08,310 --> 01:23:06,400

which was a venture of the the

1927

01:23:10,870 --> 01:23:08,320

cheltenham festivals group which

1928

01:23:12,070 --> 01:23:10,880

produces jazz music literature and

1929

01:23:14,070 --> 01:23:12,080

science

1930

01:23:16,709 --> 01:23:14,080

sometimes a strange combination in our

1931

01:23:19,590 --> 01:23:16,719

primordial soup of having science in an

1932

01:23:21,350 --> 01:23:19,600

arts organization but in the end

1933

01:23:23,350 --> 01:23:21,360

uh arts and science is all part of

1934

01:23:25,350 --> 01:23:23,360

culture and i think the more that we

1935

01:23:26,950 --> 01:23:25,360

actually get the two sets of disciplines

1936

01:23:29,430 --> 01:23:26,960

working together i think the better

1937

01:23:32,470 --> 01:23:29,440

we'll all be at communicating

1938

01:23:35,990 --> 01:23:32,480

uh so fame lab was basically set up as a

1939

01:23:38,550 --> 01:23:36,000

talent pool uh a pipeline if you like to

1940

01:23:41,110 --> 01:23:38,560

feed into the into the science festival

1941

01:23:43,510 --> 01:23:41,120

knowing that there was a shortage of top

1942

01:23:47,189 --> 01:23:43,520

communicators even in the uk where we do

1943

01:23:49,830 --> 01:23:47,199

have a history of science communication

1944

01:23:51,270 --> 01:23:49,840

for that uh what soon became apparent is

1945

01:23:53,750 --> 01:23:51,280

we'd actually sort of touched a bit of a

1946

01:23:56,229 --> 01:23:53,760

nerve uh with uh with fame lab and it

1947

01:23:57,830 --> 01:23:56,239

soon got to be noticed elsewhere

1948

01:23:59,990 --> 01:23:57,840

uh so it was a case of sort of light the

1949

01:24:01,830 --> 01:24:00,000

blue touch paper and stand well back and

1950

01:24:05,030 --> 01:24:01,840

we were somewhat surprised at the

1951

01:24:06,629 --> 01:24:05,040

explosion of interest in operating fame

1952

01:24:08,229 --> 01:24:06,639

lab

1953

01:24:09,910 --> 01:24:08,239

on a global basis we couldn't have done

1954

01:24:10,950 --> 01:24:09,920

it without the support of the british

1955

01:24:12,870 --> 01:24:10,960

council

1956

01:24:14,950 --> 01:24:12,880

who are a part government organization

1957

01:24:16,629 --> 01:24:14,960

who operate in many many countries

1958

01:24:18,709 --> 01:24:16,639

around the world

1959

01:24:19,830 --> 01:24:18,719

they helped us take the the family

1960

01:24:22,709 --> 01:24:19,840

competition

1961

01:24:24,870 --> 01:24:22,719

uh in from an infrastructure perspective

1962

01:24:26,229 --> 01:24:24,880

like we have with nasa here it's very

1963

01:24:28,310 --> 01:24:26,239

very important that we have people on

1964

01:24:31,030 --> 01:24:28,320

the ground who are committed who can

1965

01:24:33,669 --> 01:24:31,040

actually work with the local groups uh

1966

01:24:36,629 --> 01:24:33,679

to put these competitions on

1967

01:24:39,510 --> 01:24:36,639

and now it's running from israel to hong

1968

01:24:42,870 --> 01:24:39,520

kong from lithuania and poland

1969

01:24:45,669 --> 01:24:42,880

uh down to south africa and of course

1970

01:24:47,510 --> 01:24:45,679

with nasa and a small group in

1971

01:24:49,110 --> 01:24:47,520

switzerland called cern i'm not exactly

1972

01:24:50,310 --> 01:24:49,120

sure what they do

1973

01:24:52,149 --> 01:24:50,320

but uh

1974

01:24:54,310 --> 01:24:52,159

we're also very proud to be able to work

1975

01:24:56,470 --> 01:24:54,320

with with them

1976

01:24:58,470 --> 01:24:56,480

so fame lab basically

1977

01:25:00,629 --> 01:24:58,480

is the future of science communication

1978

01:25:02,629 --> 01:25:00,639

in many areas a lot of countries that we

1979

01:25:04,950 --> 01:25:02,639

work in they've never really done

1980

01:25:07,430 --> 01:25:04,960

science communication it's always been

1981

01:25:09,910 --> 01:25:07,440

the professors talking to the people and

1982

01:25:11,510 --> 01:25:09,920

not listening to the people and no

1983

01:25:13,030 --> 01:25:11,520

dialogue with them

1984

01:25:15,430 --> 01:25:13,040

so for us it's all about public

1985

01:25:16,790 --> 01:25:15,440

engagement it's getting organizations

1986

01:25:19,030 --> 01:25:16,800

and individuals

1987

01:25:21,350 --> 01:25:19,040

to take science seriously and the fact

1988

01:25:23,669 --> 01:25:21,360

that people aren't stupid they know when

1989

01:25:26,390 --> 01:25:23,679

uh the truth is being told uh you just

1990

01:25:28,390 --> 01:25:26,400

have to explain it in creative ways and

1991

01:25:30,550 --> 01:25:28,400

these guys today have done a fantastic

1992

01:25:31,350 --> 01:25:30,560

job i've learned a lot i've seen a lot

1993

01:25:33,030 --> 01:25:31,360

of

1994

01:25:35,430 --> 01:25:33,040

fame like competitions over the last

1995

01:25:37,030 --> 01:25:35,440

couple of years and they're very very

1996

01:25:39,030 --> 01:25:37,040

talented group

1997

01:25:40,390 --> 01:25:39,040

so fame lab really is

1998

01:25:41,990 --> 01:25:40,400

breaking borders

1999

01:25:43,669 --> 01:25:42,000

uh it's going to go into many more

2000

01:25:46,229 --> 01:25:43,679

countries over the next

2001

01:25:48,550 --> 01:25:46,239

couple of years uh hopefully into india

2002

01:25:50,629 --> 01:25:48,560

into china in brazil

2003

01:25:53,430 --> 01:25:50,639

uh in india it will be an interesting

2004

01:25:55,430 --> 01:25:53,440

one being a competition driven

2005

01:25:57,510 --> 01:25:55,440

country i think letting fame lab off in

2006

01:26:00,229 --> 01:25:57,520

there will be very very interesting

2007

01:26:03,430 --> 01:26:00,239

so again many many thanks we appreciate

2008

01:26:05,110 --> 01:26:03,440

all your help and uh and uh an interest

2009

01:26:06,550 --> 01:26:05,120

and i'll hand you back to sean we'll

2010

01:26:08,950 --> 01:26:06,560

finish off the rest and of course the

2011

01:26:10,550 --> 01:26:08,960

main act and me being on the same stage

2012

01:26:12,950 --> 01:26:10,560

as nichelle that is

2013

01:26:18,310 --> 01:26:12,960

that is just it that

2014

01:26:22,470 --> 01:26:20,390

so we have one more speaker this evening

2015

01:26:24,070 --> 01:26:22,480

and she is going to not be limited to

2016

01:26:26,070 --> 01:26:24,080

three minutes please join me in

2017

01:26:27,590 --> 01:26:26,080

re-welcoming miss michelle nichols to

2018

01:26:29,350 --> 01:26:27,600

the stage

2019

01:26:33,030 --> 01:26:29,360

thank you very much

2020

01:26:37,270 --> 01:26:34,870

wow

2021

01:26:39,669 --> 01:26:37,280

i don't know what to say after all of

2022

01:27:01,750 --> 01:26:39,679

this but i know that my brain

2023

01:27:08,629 --> 01:27:05,110

the magic that you have brought to

2024

01:27:13,430 --> 01:27:08,639

science and the communication

2025

01:27:13,440 --> 01:27:16,790

communicate

2026

01:27:16,800 --> 01:27:23,270

so brilliantly so

2027

01:27:28,310 --> 01:27:26,149

so immediately

2028

01:27:30,149 --> 01:27:28,320

i want to thank you each each and every

2029

01:27:34,149 --> 01:27:30,159

one of you

2030

01:27:39,430 --> 01:27:36,950

when i decided what i wanted to be i was

2031

01:27:41,270 --> 01:27:39,440

a very very young

2032

01:27:44,550 --> 01:27:41,280

girl

2033

01:27:49,510 --> 01:27:47,990

i always wanted to be everything

2034

01:27:54,950 --> 01:27:49,520

i

2035

01:27:58,070 --> 01:27:54,960

ballet

2036

01:28:03,750 --> 01:27:58,080

and then to afro-cuban and modern and

2037

01:28:06,790 --> 01:28:05,350

and acting

2038

01:28:08,390 --> 01:28:06,800

was just

2039

01:28:09,830 --> 01:28:08,400

a natural thing

2040

01:28:12,070 --> 01:28:09,840

with me

2041

01:28:16,070 --> 01:28:12,080

and i see that with you

2042

01:28:18,709 --> 01:28:16,080

that what you put what possesses you is

2043

01:28:21,189 --> 01:28:18,719

a natural part of you it's just

2044

01:28:23,189 --> 01:28:21,199

wonderful to behold

2045

01:28:27,510 --> 01:28:23,199

and i think

2046

01:28:33,350 --> 01:28:30,390

wonderful career the ups and the downs

2047

01:28:34,390 --> 01:28:33,360

and the in-betweens and the sideways and

2048

01:28:37,750 --> 01:28:34,400

the

2049

01:28:41,910 --> 01:28:37,760

great blowouts have all added to who i

2050

01:28:44,790 --> 01:28:41,920

am they all add to who you are

2051  
01:28:50,390 --> 01:28:47,990  
and i give thanks to every up and down

2052  
01:28:53,350 --> 01:28:50,400  
moment of my life

2053  
01:28:54,870 --> 01:28:53,360  
because it has been a long and varied

2054  
01:28:57,590 --> 01:28:54,880  
life

2055  
01:29:02,550 --> 01:28:57,600  
and i'd like

2056  
01:29:08,870 --> 01:29:06,070  
and i don't say that facetiously

2057  
01:29:11,910 --> 01:29:08,880  
i don't think that it's impossible

2058  
01:29:15,110 --> 01:29:11,920  
because we've come such a long ways

2059  
01:29:19,590 --> 01:29:17,590  
40 to 60 being

2060  
01:29:23,750 --> 01:29:19,600  
old

2061  
01:29:28,870 --> 01:29:23,760  
we're

2062  
01:29:33,430 --> 01:29:31,430  
we don't have time to grow old

2063  
01:29:41,750 --> 01:29:33,440

we've got too much to do

2064

01:29:41,760 --> 01:29:46,950

i always knew what i wanted to do

2065

01:29:51,830 --> 01:29:49,030

as i said

2066

01:29:53,669 --> 01:29:51,840

and i was doing

2067

01:29:55,590 --> 01:29:53,679

and i was

2068

01:29:57,830 --> 01:29:55,600

invited i've traveled all over the world

2069

01:29:58,950 --> 01:29:57,840

well maybe not all over the world but

2070

01:30:00,790 --> 01:29:58,960

um

2071

01:30:02,149 --> 01:30:00,800

pretty much

2072

01:30:04,550 --> 01:30:02,159

and i had

2073

01:30:08,790 --> 01:30:04,560

been in london

2074

01:30:11,430 --> 01:30:08,800

and i had decided i had never seen paris

2075

01:30:13,830 --> 01:30:11,440

and i'd been to london several times but

2076

01:30:16,149 --> 01:30:13,840

always had to get back right away now i

2077

01:30:19,350 --> 01:30:16,159

had nothing to do really really that was

2078

01:30:22,310 --> 01:30:19,360

going to keep me and i went to gay parry

2079

01:30:25,669 --> 01:30:22,320

and i when i got there and friend met

2080

01:30:27,990 --> 01:30:25,679

friends there i said this is

2081

01:30:30,709 --> 01:30:28,000

the beginning of my home this is where

2082

01:30:32,790 --> 01:30:30,719

i'm going to be for the rest of my life

2083

01:30:35,430 --> 01:30:32,800

this is where i'm going to express

2084

01:30:38,950 --> 01:30:35,440

myself until i got a phone call from my

2085

01:30:44,310 --> 01:30:41,110

and he said come home they're doing star

2086

01:30:50,470 --> 01:30:48,310

i didn't know what a star trek was

2087

01:30:52,470 --> 01:30:50,480

i said i'm not coming home

2088

01:30:54,790 --> 01:30:52,480

i'm sending for my son

2089

01:30:57,189 --> 01:30:54,800

and my little son and we're go i'm going

2090

01:31:02,709 --> 01:30:57,199

to live in europe and i'm going he says

2091

01:31:07,910 --> 01:31:05,270

and he thought i knew what star trek was

2092

01:31:10,229 --> 01:31:07,920

but i really didn't

2093

01:31:12,470 --> 01:31:10,239

and the thing was gene roddenberry three

2094

01:31:13,669 --> 01:31:12,480

years before star trek had given me my

2095

01:31:16,390 --> 01:31:13,679

first

2096

01:31:19,669 --> 01:31:16,400

guest star billing in a show that he had

2097

01:31:20,950 --> 01:31:19,679

called the lieutenant with gary lockwood

2098

01:31:25,590 --> 01:31:20,960

and

2099

01:31:26,950 --> 01:31:25,600

nothing happened

2100

01:31:29,350 --> 01:31:26,960

and

2101

01:31:30,470 --> 01:31:29,360

my work was always

2102

01:31:34,550 --> 01:31:30,480

in europe

2103

01:31:36,390 --> 01:31:34,560

and i loved it and i was not coming home

2104

01:31:39,030 --> 01:31:36,400

and then he made me an offer i couldn't

2105

01:31:43,270 --> 01:31:40,229

he said

2106

01:31:45,910 --> 01:31:43,280

you there'll be a first-class round-trip

2107

01:31:47,430 --> 01:31:45,920

ticket on air france or wherever you

2108

01:31:50,709 --> 01:31:47,440

want it

2109

01:31:54,870 --> 01:31:50,719

you come here and go to this interview

2110

01:31:56,310 --> 01:31:54,880

and if you don't get it you can be back

2111

01:31:58,629 --> 01:31:56,320

in europe

2112

01:31:59,669 --> 01:31:58,639

in less than a week and the ticket is on

2113

01:32:00,709 --> 01:31:59,679

me

2114

01:32:02,709 --> 01:32:00,719

i went

2115

01:32:04,790 --> 01:32:02,719

hmm

2116

01:32:08,390 --> 01:32:04,800

i can go home and get my son and bring

2117

01:32:12,310 --> 01:32:08,400

him back and won't cost me anything

2118

01:32:15,350 --> 01:32:12,320

but i didn't agree very fast and he said

2119

01:32:21,110 --> 01:32:18,470

i said okay deal

2120

01:32:22,470 --> 01:32:21,120

well in the meantime having lived in

2121

01:32:24,070 --> 01:32:22,480

europa for

2122

01:32:27,189 --> 01:32:24,080

some time

2123

01:32:29,110 --> 01:32:27,199

enough to say this is where i want to be

2124

01:32:32,070 --> 01:32:29,120

i had um

2125

01:32:34,870 --> 01:32:32,080

glamorized myself become very open don't

2126  
01:32:38,629 --> 01:32:37,030  
i had cut my hair and i wore it in a

2127  
01:32:41,430 --> 01:32:38,639  
natural

2128  
01:32:42,629 --> 01:32:41,440  
and i wore it short in the back

2129  
01:32:46,149 --> 01:32:42,639  
and i

2130  
01:32:49,510 --> 01:32:46,159  
had straight sideburns

2131  
01:32:52,629 --> 01:32:49,520  
and a pointed bang

2132  
01:32:54,870 --> 01:32:52,639  
and a high natural

2133  
01:32:58,470 --> 01:32:54,880  
and someone had taken me to where i

2134  
01:33:02,550 --> 01:33:00,870  
designer clothes for a lot less than no

2135  
01:33:03,830 --> 01:33:02,560  
jobs my phone

2136  
01:33:05,750 --> 01:33:03,840  
and uh

2137  
01:33:09,510 --> 01:33:05,760  
when i came back

2138  
01:33:13,110 --> 01:33:09,520

i went into them thusly

2139

01:33:16,390 --> 01:33:13,120  
with my dior suit on and my hair

2140

01:33:16,400 --> 01:33:20,470  
the office where other girls were

2141

01:33:24,550 --> 01:33:23,030  
seating waiting to go in

2142

01:33:26,070 --> 01:33:24,560  
and they looked up at me and they're

2143

01:33:29,189 --> 01:33:26,080  
reading the scripts and they looked up

2144

01:33:29,199 --> 01:33:34,149  
and they looked at each other and went

2145

01:33:38,709 --> 01:33:36,629  
because you see actors going out for a

2146

01:33:41,430 --> 01:33:38,719  
role

2147

01:33:43,430 --> 01:33:41,440  
god forbid anybody thinks they really

2148

01:33:45,590 --> 01:33:43,440  
really really need this role so we

2149

01:33:47,030 --> 01:33:45,600  
usually go out in

2150

01:33:49,669 --> 01:33:47,040  
slacks or

2151  
01:33:51,189 --> 01:33:49,679  
jeans and a sweater and you know we

2152  
01:33:57,350 --> 01:33:51,199  
really

2153  
01:34:01,189 --> 01:33:59,110  
and here i am

2154  
01:34:04,229 --> 01:34:01,199  
walking in like

2155  
01:34:05,830 --> 01:34:04,239  
it's important

2156  
01:34:08,470 --> 01:34:05,840  
and i had

2157  
01:34:11,110 --> 01:34:08,480  
i always read when i'm

2158  
01:34:13,510 --> 01:34:11,120  
i read a lot but i always read a big

2159  
01:34:16,229 --> 01:34:13,520  
book i carry a big book especially if

2160  
01:34:19,270 --> 01:34:16,239  
i'm flying across

2161  
01:34:23,110 --> 01:34:19,280  
the waters to another country

2162  
01:34:25,669 --> 01:34:23,120  
and i was reading this one book

2163  
01:34:29,510 --> 01:34:25,679

which was a bestseller and i was about

2164

01:34:30,830 --> 01:34:29,520

three a quart a quarter of them

2165

01:34:32,790 --> 01:34:30,840

of the book

2166

01:34:35,750 --> 01:34:32,800

through and

2167

01:34:36,629 --> 01:34:35,760

i came in with the book

2168

01:34:39,990 --> 01:34:36,639

and

2169

01:34:42,709 --> 01:34:40,000

they took me in front of the other girls

2170

01:34:48,470 --> 01:34:42,719

who were there because i told them that

2171

01:34:54,629 --> 01:34:51,750

which really isn't done

2172

01:34:56,310 --> 01:34:54,639

if you're serious about getting the role

2173

01:34:58,950 --> 01:34:56,320

they would have told you

2174

01:35:01,430 --> 01:34:58,960

well go ahead and you know when you find

2175

01:35:03,109 --> 01:35:01,440

time come again they said oh of course

2176

01:35:06,790 --> 01:35:03,119

miss nichols

2177

01:35:10,229 --> 01:35:06,800

and i thought that felt good yes

2178

01:35:11,669 --> 01:35:10,239

so i walked in with this big book

2179

01:35:17,030 --> 01:35:11,679

and

2180

01:35:26,310 --> 01:35:20,550

the producer the director

2181

01:35:30,070 --> 01:35:28,149

and they looked up at me and they looked

2182

01:35:32,149 --> 01:35:30,080

at each other and they said

2183

01:35:33,030 --> 01:35:32,159

they almost got up

2184

01:35:37,430 --> 01:35:33,040

you know

2185

01:35:41,510 --> 01:35:37,440

hello miss nichols um oh come sit down

2186

01:35:45,189 --> 01:35:43,030

and i

2187

01:35:48,629 --> 01:35:45,199

thanked them you know

2188

01:35:53,750 --> 01:35:48,639

and they looked at my hair and they

2189

01:35:53,760 --> 01:36:00,310

leather shoes and bag to match

2190

01:36:06,709 --> 01:36:03,270

my wife has that book

2191

01:36:08,950 --> 01:36:06,719

she just bought it she's raving over it

2192

01:36:11,270 --> 01:36:08,960

another one said yes i have i've just

2193

01:36:13,669 --> 01:36:11,280

bought it i i just haven't gotten a

2194

01:36:15,750 --> 01:36:13,679

chance to open it everybody knew about

2195

01:36:26,629 --> 01:36:15,760

the book

2196

01:36:28,550 --> 01:36:26,639

and 25 minutes later they said maybe we

2197

01:36:32,870 --> 01:36:28,560

should find out what miss nichols has

2198

01:36:35,990 --> 01:36:32,880

come here for would you please read

2199

01:36:40,629 --> 01:36:36,000

oh i'd be delighted to

2200

01:36:43,430 --> 01:36:42,390

bones

2201

01:36:46,870 --> 01:36:43,440

kirk

2202

01:36:49,109 --> 01:36:46,880

and somebody named spock

2203

01:36:53,030 --> 01:36:49,119

and they said and it was a wonderful

2204

01:36:55,750 --> 01:36:53,040

long three-page long scene and so they

2205

01:36:59,830 --> 01:36:55,760

said would you mind reading the role of

2206

01:37:04,790 --> 01:37:01,990

i said i don't mind reading

2207

01:37:07,189 --> 01:37:04,800

either any one of them they're wonderful

2208

01:37:10,470 --> 01:37:07,199

to him in my mind

2209

01:37:12,790 --> 01:37:10,480

and so i ran and i said okay

2210

01:37:14,390 --> 01:37:12,800

um and look through and through and so

2211

01:37:15,910 --> 01:37:14,400

and they said take your time and i said

2212

01:37:17,990 --> 01:37:15,920

i'm going to assume

2213

01:37:20,550 --> 01:37:18,000

i said tell me something about this

2214

01:37:24,870 --> 01:37:20,560

character spock

2215

01:37:28,870 --> 01:37:26,790

and they all looked at each other and

2216

01:37:31,830 --> 01:37:28,880

they said

2217

01:37:33,750 --> 01:37:31,840

don't you know anything about

2218

01:37:40,629 --> 01:37:33,760

this show we're doing

2219

01:37:43,510 --> 01:37:42,550

and they said oh

2220

01:37:44,950 --> 01:37:43,520

well

2221

01:37:47,910 --> 01:37:44,960

the first

2222

01:37:50,709 --> 01:37:47,920

pilot didn't sell and we're redoing the

2223

01:37:53,750 --> 01:37:50,719

pilot and we've decided to put a new

2224

01:37:56,470 --> 01:37:53,760

character in the communications officer

2225

01:37:58,550 --> 01:37:56,480

i said oh spock is a communication so

2226

01:38:03,270 --> 01:37:58,560

he's no no no no

2227

01:38:06,709 --> 01:38:04,950

it's a male

2228

01:38:13,109 --> 01:38:06,719

i said oh

2229

01:38:19,030 --> 01:38:16,390

could it be a female

2230

01:38:21,510 --> 01:38:19,040

and they said

2231

01:38:24,390 --> 01:38:21,520

well yes but linda namoy would not like

2232

01:38:28,790 --> 01:38:26,629

ah a name

2233

01:38:31,430 --> 01:38:28,800

so i said well

2234

01:38:34,870 --> 01:38:31,440

why don't you tell me if

2235

01:38:37,030 --> 01:38:34,880

can i pretend it is a female i can

2236

01:38:40,550 --> 01:38:37,040

if you tell me the characteristics of

2237

01:38:43,910 --> 01:38:40,560

the character i'll

2238

01:38:45,030 --> 01:38:43,920

utilize those and be give you this

2239

01:38:47,350 --> 01:38:45,040

character

2240

01:38:49,990 --> 01:38:47,360

and you'll know if i can act and if you

2241

01:38:51,430 --> 01:38:50,000

really want me in that

2242

01:38:53,590 --> 01:38:51,440

for the role

2243

01:38:56,390 --> 01:38:53,600

and they said fair enough so they told

2244

01:38:59,109 --> 01:38:56,400

me how this character was

2245

01:39:00,390 --> 01:38:59,119

um

2246

01:39:02,149 --> 01:39:00,400

had

2247

01:39:03,990 --> 01:39:02,159

an oster

2248

01:39:05,270 --> 01:39:04,000

characteristic

2249

01:39:08,790 --> 01:39:05,280

um

2250

01:39:10,629 --> 01:39:08,800

all the things that you now know

2251

01:39:12,950 --> 01:39:10,639

of that character

2252

01:39:17,109 --> 01:39:12,960

and somebody said he has green blood and

2253

01:39:21,910 --> 01:39:19,510

well i can't do green blood pointed ears

2254

01:39:25,270 --> 01:39:21,920

but i can do the characteristics

2255

01:39:28,390 --> 01:39:25,280

and so i read for the character

2256

01:39:30,550 --> 01:39:28,400

and i went through one page and

2257

01:39:32,470 --> 01:39:30,560

they had me keep going whoever was

2258

01:39:34,229 --> 01:39:32,480

reading the other characters

2259

01:39:34,870 --> 01:39:34,239

i went to the second label they took me

2260

01:39:38,470 --> 01:39:34,880

all

2261

01:39:41,270 --> 01:39:38,480

and they said

2262

01:39:42,709 --> 01:39:41,280

wow they don't usually do that juicy as

2263

01:39:45,109 --> 01:39:42,719

you know

2264

01:39:47,109 --> 01:39:45,119

and um

2265

01:39:50,390 --> 01:39:47,119

and so they said

2266

01:39:51,189 --> 01:39:50,400

thank you miss nichols for coming in

2267

01:39:52,629 --> 01:39:51,199

and

2268

01:39:54,950 --> 01:39:52,639

so i

2269

01:39:57,669 --> 01:39:54,960

said thank you and they said and the

2270

01:39:58,870 --> 01:39:57,679

director said and miss nichols would you

2271

01:40:02,070 --> 01:39:58,880

wait

2272

01:40:04,390 --> 01:40:02,080

oh that is such a good sign

2273

01:40:06,830 --> 01:40:04,400

it means that you're in contention with

2274

01:40:08,390 --> 01:40:06,840

someone else that you're you're up for

2275

01:40:13,109 --> 01:40:08,400

it

2276

01:40:16,470 --> 01:40:14,310

and so

2277

01:40:23,189 --> 01:40:16,480

i came out and all the girls were

2278

01:40:27,109 --> 01:40:25,510

it only took about five minutes to read

2279

01:40:29,910 --> 01:40:27,119

the thing

2280

01:40:31,669 --> 01:40:29,920

but the rest was on this book

2281

01:40:34,390 --> 01:40:31,679

so

2282

01:40:36,310 --> 01:40:34,400

peg uh penny took the the secretary took

2283

01:40:37,750 --> 01:40:36,320

me into a little ante room and said

2284

01:40:39,990 --> 01:40:37,760

would you wait

2285

01:40:42,950 --> 01:40:40,000

so i went and i picked out my book and i

2286

01:40:47,270 --> 01:40:42,960

curled up on the sofa and i was reading

2287

01:40:49,510 --> 01:40:47,280

my book and the director about

2288

01:40:52,790 --> 01:40:49,520

an hour later

2289

01:40:54,870 --> 01:40:52,800

peeked his head in and said

2290

01:41:00,550 --> 01:40:54,880

he's looking for somebody what are you

2291

01:41:04,229 --> 01:41:02,550

well i've got a paid ticket back to

2292

01:41:06,149 --> 01:41:04,239

europe

2293

01:41:08,310 --> 01:41:06,159

and i said

2294

01:41:09,430 --> 01:41:08,320

you told me to wait

2295

01:41:11,030 --> 01:41:09,440

he said

2296

01:41:13,350 --> 01:41:11,040

oh

2297

01:41:15,189 --> 01:41:13,360

didn't anybody tell you

2298

01:41:17,430 --> 01:41:15,199

i'm picking my stuff i said it's quite

2299

01:41:19,350 --> 01:41:17,440

all right he says no you had it when you

2300

01:41:23,270 --> 01:41:19,360

walked in the door come on let's go to

2301

01:41:28,790 --> 01:41:26,870

and then i got a call for

2302

01:41:30,550 --> 01:41:28,800

well i don't have to payment

2303

01:41:32,709 --> 01:41:30,560

now i've got to pay my

2304

01:41:35,350 --> 01:41:32,719

agent back

2305

01:41:38,310 --> 01:41:35,360

because i've got the role

2306

01:41:41,109 --> 01:41:38,320

and uh of course it's the best

2307

01:41:46,790 --> 01:41:41,119

payback i ever did

2308

01:41:48,149 --> 01:41:46,800

but now i get a call for for fitting

2309

01:41:54,870 --> 01:41:48,159

and

2310

01:41:57,109 --> 01:41:54,880

gene roddenberry called down he knows

2311

01:41:58,790 --> 01:41:57,119

you're having a fitting he wants you to

2312

01:42:01,030 --> 01:41:58,800

come to his office

2313

01:42:03,750 --> 01:42:01,040

so i go to his office after the fitting

2314

01:42:09,109 --> 01:42:05,270

with my book

2315

01:42:12,470 --> 01:42:09,119

and he said it's about that book

2316

01:42:13,510 --> 01:42:12,480

i said yes he said come on let's go have

2317

01:42:17,350 --> 01:42:13,520

lunch

2318

01:42:18,950 --> 01:42:17,360

and we

2319

01:42:21,270 --> 01:42:18,960

went to lunch and was

2320

01:42:22,950 --> 01:42:21,280

not very many people there

2321

01:42:25,270 --> 01:42:22,960

so he said well let's celebrate and he

2322

01:42:28,470 --> 01:42:25,280

bought me a bottle a glass a bottle of

2323

01:42:30,390 --> 01:42:28,480

champagne to celebrate my

2324

01:42:33,109 --> 01:42:30,400

getting the role

2325

01:42:35,750 --> 01:42:33,119

and so he said by the way i never told

2326

01:42:38,470 --> 01:42:35,760

anybody that i knew you or had

2327

01:42:39,590 --> 01:42:38,480

if they didn't know you had a role three

2328

01:42:42,629 --> 01:42:39,600

years ago

2329

01:42:45,270 --> 01:42:42,639

you got it on your own

2330

01:42:47,590 --> 01:42:45,280

and that i was delighted so he said i

2331

01:42:49,590 --> 01:42:47,600

want to talk about that book

2332

01:42:52,310 --> 01:42:49,600

he said it's something about the

2333

01:42:54,149 --> 01:42:52,320

character the name of that book that i'd

2334

01:42:57,189 --> 01:42:54,159

like to use

2335

01:42:58,709 --> 01:42:57,199

for your character but it's a little bit

2336

01:43:02,390 --> 01:42:58,719

too harsh

2337

01:43:04,629 --> 01:43:02,400

and the name of the book was uhuru

2338

01:43:05,990 --> 01:43:04,639

which was a beautiful treatise

2339

01:43:07,910 --> 01:43:06,000

on

2340

01:43:08,870 --> 01:43:07,920

africa

2341

01:43:10,790 --> 01:43:08,880

and

2342

01:43:12,629 --> 01:43:10,800

which i had explained to all the guys in

2343

01:43:14,390 --> 01:43:12,639

the room what it was about and they were

2344

01:43:16,709 --> 01:43:14,400

fascinated

2345

01:43:19,109 --> 01:43:16,719

and he said but i'd like to

2346

01:43:21,910 --> 01:43:19,119

so i picked up my champagne now that i

2347

01:43:23,109 --> 01:43:21,920

have a job

2348

01:43:33,109 --> 01:43:23,119

and

2349

01:43:36,070 --> 01:43:33,119

soften the end of it instead of an uhuru

2350

01:43:37,430 --> 01:43:36,080

put an a on the end of it uhura

2351  
01:43:38,950 --> 01:43:37,440

jean said

2352  
01:43:41,109 --> 01:43:38,960

that's it

2353  
01:43:42,870 --> 01:43:41,119

that's exactly what i want now i know

2354  
01:43:47,830 --> 01:43:42,880

where you're from you're from the united

2355  
01:43:51,750 --> 01:43:49,189

are part of

2356  
01:43:53,990 --> 01:43:51,760

starfleet command you've had a whole

2357  
01:43:56,550 --> 01:43:54,000

background and he just went on and he

2358  
01:44:00,149 --> 01:43:56,560

was so delighted

2359  
01:44:02,310 --> 01:44:01,030

and

2360  
01:44:06,870 --> 01:44:02,320

actually

2361  
01:44:10,310 --> 01:44:06,880

that is the the way uhura got her name

2362  
01:44:11,990 --> 01:44:10,320

and the way i got the role

2363  
01:44:13,030 --> 01:44:12,000

it tells you

2364

01:44:14,229 --> 01:44:13,040

that

2365

01:44:15,189 --> 01:44:14,239

you really

2366

01:44:16,070 --> 01:44:15,199

never

2367

01:44:17,830 --> 01:44:16,080

know

2368

01:44:19,910 --> 01:44:17,840

in life

2369

01:44:23,270 --> 01:44:19,920

with all that you know and all that

2370

01:44:25,350 --> 01:44:23,280

you've done or not done

2371

01:44:27,990 --> 01:44:25,360

what's going

2372

01:44:30,629 --> 01:44:28,000

to happen

2373

01:44:36,950 --> 01:44:30,639

with all that you know

2374

01:44:42,229 --> 01:44:39,910

on interviews and didn't get them all

2375

01:44:46,950 --> 01:44:42,239

those years

2376

01:44:49,510 --> 01:44:46,960

suddenly every experience in my life

2377

01:44:51,990 --> 01:44:49,520

took fire

2378

01:44:55,109 --> 01:44:52,000

and allowed me to create

2379

01:44:57,990 --> 01:44:55,119

this wonderful character i

2380

01:44:59,990 --> 01:44:58,000

i don't call it me

2381

01:45:02,950 --> 01:45:00,000

i call it her

2382

01:45:04,149 --> 01:45:02,960

because she is another character in my

2383

01:45:06,070 --> 01:45:04,159

life

2384

01:45:09,109 --> 01:45:06,080

and all that you know

2385

01:45:10,470 --> 01:45:09,119

will be the same you can never undo what

2386

01:45:11,590 --> 01:45:10,480

you know

2387

01:45:14,709 --> 01:45:11,600

you can

2388

01:45:14,719 --> 01:45:18,629

do something else

2389

01:45:22,870 --> 01:45:21,350

but what you have no one can take away

2390

01:45:25,910 --> 01:45:22,880

from you

2391

01:45:26,950 --> 01:45:25,920

and it will enrich your life

2392

01:45:33,669 --> 01:45:26,960

as

2393

01:45:35,430 --> 01:45:33,679

for many years to come

2394

01:45:44,709 --> 01:45:35,440

i

2395

01:45:47,590 --> 01:45:44,719

by not only your knowledge

2396

01:45:50,149 --> 01:45:47,600

but how you've absorbed it

2397

01:45:51,109 --> 01:45:50,159

how you've presented

2398

01:45:54,070 --> 01:45:51,119

us

2399

01:45:54,950 --> 01:45:54,080

with an insight i can feel

2400

01:46:03,750 --> 01:45:54,960

you

2401  
01:46:06,790 --> 01:46:03,760  
knowledge and made it part

2402  
01:46:08,629 --> 01:46:06,800  
of your life of who you are

2403  
01:46:11,510 --> 01:46:08,639  
and so

2404  
01:46:14,550 --> 01:46:11,520  
today i want to tell you that

2405  
01:46:16,470 --> 01:46:14,560  
each and every one of you

2406  
01:46:19,430 --> 01:46:16,480  
are winners

2407  
01:46:20,950 --> 01:46:19,440  
because you proved it on this stage

2408  
01:46:21,990 --> 01:46:20,960  
today

2409  
01:46:25,270 --> 01:46:22,000  
and

2410  
01:46:26,550 --> 01:46:25,280  
sometimes we only get one chance to

2411  
01:46:28,390 --> 01:46:26,560  
prove

2412  
01:46:31,590 --> 01:46:28,400  
who we are

2413  
01:46:32,870 --> 01:46:31,600

but who you really are what you own you

2414

01:46:35,590 --> 01:46:32,880

own that

2415

01:46:38,790 --> 01:46:35,600

and can never be taken away from you and

2416

01:46:43,270 --> 01:46:38,800

what you've given us the insight of how

2417

01:46:47,910 --> 01:46:45,830

i'll never forget it

2418

01:46:50,709 --> 01:46:47,920

and you'll never forget it

2419

01:46:52,629 --> 01:46:50,719

because you got to demonstrate it you

2420

01:46:53,510 --> 01:46:52,639

probably even

2421

01:46:57,109 --> 01:46:53,520

yet

2422

01:47:03,910 --> 01:47:01,510

the jewel that you just received today

2423

01:47:06,830 --> 01:47:03,920

to stand on stage

2424

01:47:09,189 --> 01:47:06,840

and open yourself

2425

01:47:09,910 --> 01:47:09,199

up each

2426  
01:47:12,149 --> 01:47:09,920  
in

2427  
01:47:14,470 --> 01:47:12,159  
such

2428  
01:47:16,950 --> 01:47:14,480  
diverse and unique

2429  
01:47:17,669 --> 01:47:16,960  
ways

2430  
01:47:19,830 --> 01:47:17,679  
and

2431  
01:47:21,590 --> 01:47:19,840  
those of you who are still in the

2432  
01:47:24,950 --> 01:47:21,600  
audience who were

2433  
01:47:29,030 --> 01:47:24,960  
up for this and anyone

2434  
01:47:34,870 --> 01:47:33,430  
we have jewels within us

2435  
01:47:37,910 --> 01:47:34,880  
that we

2436  
01:47:40,070 --> 01:47:37,920  
don't even realize yet

2437  
01:47:44,470 --> 01:47:40,080  
you have knowledge

2438  
01:47:49,030 --> 01:47:46,310

well

2439

01:47:50,390 --> 01:47:49,040

it's what i do

2440

01:47:52,709 --> 01:47:50,400

it pays my

2441

01:47:55,109 --> 01:47:52,719

bills

2442

01:47:57,590 --> 01:47:55,119

or i'm glad to be a scientist or i'm

2443

01:47:59,270 --> 01:47:57,600

glad to be working i'm glad to be a

2444

01:48:03,430 --> 01:47:59,280

secretariat

2445

01:48:14,229 --> 01:48:08,229

affects another being

2446

01:48:16,390 --> 01:48:14,239

something grows from there

2447

01:48:19,189 --> 01:48:16,400

how i

2448

01:48:20,229 --> 01:48:19,199

being grand and

2449

01:48:21,270 --> 01:48:20,239

being

2450

01:48:23,750 --> 01:48:21,280

came

2451  
01:48:26,950 --> 01:48:23,760  
and created that rule

2452  
01:48:31,189 --> 01:48:29,750  
did something

2453  
01:48:32,709 --> 01:48:31,199  
and i had

2454  
01:48:35,510 --> 01:48:32,719  
many

2455  
01:48:35,520 --> 01:48:38,790  
come out of it

2456  
01:48:38,800 --> 01:48:43,350  
the first interracial kiss

2457  
01:48:50,629 --> 01:48:45,669  
the first black actress to have a

2458  
01:48:55,350 --> 01:48:53,430  
there's so there are so many firsts

2459  
01:48:58,229 --> 01:48:55,360  
and one of the

2460  
01:49:02,870 --> 01:48:58,239  
wonderful firsts

2461  
01:49:02,880 --> 01:49:07,430  
i came to

2462  
01:49:15,669 --> 01:49:12,070  
to be asked by nasa at nasa headquarters

2463  
01:49:18,550 --> 01:49:15,679

to come and assist them

2464

01:49:21,109 --> 01:49:18,560

come on board and assist them i said in

2465

01:49:23,830 --> 01:49:21,119

recruiting the first women

2466

01:49:25,750 --> 01:49:23,840

and minority astronauts for the space

2467

01:49:28,310 --> 01:49:25,760

shuttle program

2468

01:49:30,470 --> 01:49:28,320

all that i'm telling you led me up to

2469

01:49:36,189 --> 01:49:30,480

that

2470

01:49:39,830 --> 01:49:36,199

it led me here and to many other

2471

01:49:41,350 --> 01:49:39,840

relationships with nasa

2472

01:49:46,390 --> 01:49:41,360

so

2473

01:49:52,070 --> 01:49:47,910

or created

2474

01:49:52,080 --> 01:49:55,990

an astronaut

2475

01:50:01,109 --> 01:49:59,109

i found astronauts

2476  
01:50:04,229 --> 01:50:01,119  
and i found nasa

2477  
01:50:07,669 --> 01:50:04,239  
and whenever nasa asked me

2478  
01:50:10,390 --> 01:50:07,679  
to come and be part of

2479  
01:50:13,669 --> 01:50:10,400  
i know it's another star in the sky

2480  
01:50:18,390 --> 01:50:13,679  
another first i get to be here with you

2481  
01:50:21,990 --> 01:50:18,400  
and this is another wondrous wonderful

2482  
01:50:24,790 --> 01:50:22,000  
and i thank you all moment in my life

2483  
01:50:28,390 --> 01:50:24,800  
and thank you all for one two three four

2484  
01:56:11,589 --> 01:50:28,400  
five six seven eight nine ten eleven

2485  
01:56:11,599 --> 01:57:28,229  
brandon

2486  
01:57:32,229 --> 01:57:30,390  
all right something's wrong

2487  
01:57:34,470 --> 01:57:32,239  
how many do i get there we go that one

2488  
01:57:37,350 --> 01:57:34,480

there we go

2489

01:57:39,910 --> 01:57:37,360

all right so this pretty much concludes

2490

01:57:42,709 --> 01:57:39,920

our evening's activities

2491

01:57:45,270 --> 01:57:42,719

uh i wanna michelle michelle and i wanna

2492

01:57:48,310 --> 01:57:45,280

thank all 11 contestants and the other

2493

01:57:50,149 --> 01:57:48,320

60 of that are here that competed in all

2494

01:57:52,070 --> 01:57:50,159

of our competitions

2495

01:57:55,750 --> 01:57:52,080

we have one winner that we named tonight

2496

01:57:57,109 --> 01:57:55,760

that as a prize we are sending them to

2497

01:57:59,750 --> 01:57:57,119

the cheltenham

2498

01:58:02,709 --> 01:57:59,760

science festival this summer to compete

2499

01:58:06,550 --> 01:58:02,719

in the international competition

2500

01:58:09,189 --> 01:58:06,560

and in addition uh the gift from nasa is

2501  
01:58:12,550 --> 01:58:09,199  
we've invited the winner brendan and a

2502  
01:58:14,950 --> 01:58:12,560  
guest to join us at jpl in pasadena

2503  
01:58:18,310 --> 01:58:14,960  
california to witness the landing of the

2504  
01:58:25,589 --> 01:58:18,320  
msl rover in august 2012.

2505  
01:58:25,599 --> 01:58:34,709  
and i'll probably see you there

2506  
01:58:39,830 --> 01:58:37,990  
um so um i was just going to say that we

2507  
01:58:43,430 --> 01:58:39,840  
haven't uh you don't get the keys to the

2508  
01:58:44,149 --> 01:58:43,440  
rover but you get to watch it land

2509  
01:58:46,149 --> 01:58:44,159  
so

2510  
01:58:47,750 --> 01:58:46,159  
we've selected a single winner but we

2511  
01:58:49,589 --> 01:58:47,760  
really believe that everybody is a

2512  
01:58:52,149 --> 01:58:49,599  
winner and you know we say that and we

2513  
01:58:53,510 --> 01:58:52,159

honestly believe it we really do we are

2514

01:58:55,669 --> 01:58:53,520

committed to

2515

01:58:56,550 --> 01:58:55,679

utilizing their talents to

2516

01:58:59,109 --> 01:58:56,560

um

2517

01:59:03,109 --> 01:58:59,119

to further communicate our science

2518

01:59:05,109 --> 01:59:03,119

this is the finals for astrobiology 2012

2519

01:59:07,030 --> 01:59:05,119

fame lab but it is actually the

2520

01:59:08,709 --> 01:59:07,040

beginning of what we hope these people

2521

01:59:11,510 --> 01:59:08,719

will do and we hope that there'll be

2522

01:59:13,669 --> 01:59:11,520

continued support for their activities

2523

01:59:15,589 --> 01:59:13,679

so please give them all of you guys

2524

01:59:36,709 --> 01:59:15,599

stand up again give a final round of

2525

01:59:40,709 --> 01:59:38,470

so just a couple more things first of

2526

01:59:43,189 --> 01:59:40,719

all again i want to thank our partners

2527

01:59:47,109 --> 01:59:43,199

the cheltenham science festival

2528

01:59:48,390 --> 01:59:47,119

and the okay blue marbles space science

2529

01:59:52,149 --> 01:59:48,400

institute

2530

01:59:53,990 --> 01:59:52,159

sanjoy

2531

01:59:56,310 --> 01:59:54,000

as well as the host of our uh

2532

01:59:58,550 --> 01:59:56,320

preliminaries so the denver

2533

02:00:00,470 --> 01:59:58,560

museum of natural sciences

2534

02:00:02,390 --> 02:00:00,480

the lunar planetary institute and the

2535

02:00:05,030 --> 02:00:02,400

national geographic so we'd like to

2536

02:00:07,030 --> 02:00:05,040

thank them and some final words to all

2537

02:00:09,910 --> 02:00:07,040

of you out there

2538

02:00:14,390 --> 02:00:09,920

everybody raise their hand

2539

02:00:14,400 --> 02:00:17,510

thank you

2540

02:00:17,520 --> 02:00:20,070

space