

FADE TO BLACK

WITH JIMMY CHURCH



1
00:02:13,990 --> 00:02:11,510
[Music]

2
00:02:15,350 --> 00:02:14,000
[Applause]

3
00:02:18,270 --> 00:02:15,360
bespoke radio

4
00:02:19,910 --> 00:02:18,280
for the masses headline edition july 8

5
00:02:21,670 --> 00:02:19,920
1947

6
00:02:23,750 --> 00:02:21,680
the army air force's has announced that

7
00:02:26,070 --> 00:02:23,760
a flying beast has been found and

8
00:02:27,270 --> 00:02:26,080
is now in the possession of the army if

9
00:02:30,630 --> 00:02:27,280
the game is rigged

10
00:02:33,750 --> 00:02:30,640
change the game game changer

11
00:02:37,110 --> 00:02:33,760
i occasionally think how quickly our

12
00:02:39,830 --> 00:02:37,120
differences worldwide would vanish

13
00:02:40,630 --> 00:02:39,840

if we were facing an alien threat from

14

00:02:46,070 --> 00:02:40,640

outside

15

00:02:52,229 --> 00:02:50,070

this is with your host jimmy church on

16

00:02:58,309 --> 00:02:52,239

the game changer radio network

17

00:02:58,319 --> 00:03:02,830

i need your help to get to the year

18

00:03:02,840 --> 00:03:07,430

1985.

19

00:03:19,830 --> 00:03:09,430

you are listening to fate to flag with

20

00:03:21,100 --> 00:03:19,840

jimmy church on the game changer network

21

00:03:24,869 --> 00:03:21,110

good evening

22

00:03:30,149 --> 00:03:24,879

[Music]

23

00:03:37,910 --> 00:03:33,509

bespoke radio

24

00:03:46,020 --> 00:03:42,390

masses yeah man how you doing today

25

00:03:54,630 --> 00:03:46,030

today is wednesday january 6 2021.

26

00:03:56,780 --> 00:03:54,640

[Music]

27

00:03:58,309 --> 00:03:56,790

six days into the new year

28

00:04:01,860 --> 00:03:58,319

[Music]

29

00:04:06,149 --> 00:04:01,870

only 300 359 days left

30

00:04:09,509 --> 00:04:07,560

we are live

31

00:04:12,710 --> 00:04:09,519

[Music]

32

00:04:14,070 --> 00:04:12,720

from a bunker a bunker that is somewhere

33

00:04:17,430 --> 00:04:14,080

in the middle of beautiful downtown

34

00:04:17,440 --> 00:04:23,749

in the united states of america

35

00:04:29,830 --> 00:04:26,390

i would like to welcome everybody

36

00:04:32,310 --> 00:04:29,840

listening all around the world

37

00:04:33,830 --> 00:04:32,320

all across the united states

38

00:04:35,830 --> 00:04:33,840

[Music]

39

00:04:36,870 --> 00:04:35,840

hither and tether to and fro back and

40

00:04:40,469 --> 00:04:36,880

forth up and down

41

00:04:43,670 --> 00:04:40,479

east and west north and south

42

00:04:47,110 --> 00:04:43,680

far and near

43

00:04:50,390 --> 00:04:47,120

this is fade to black for kjcr the game

44

00:04:55,590 --> 00:04:50,400

changer network and kg are a the planets

45

00:05:01,909 --> 00:04:58,170

how you doing all right

46

00:05:05,029 --> 00:05:01,919

[Music]

47

00:05:09,029 --> 00:05:05,039

tonight we have very special guests

48

00:05:10,469 --> 00:05:09,039

joining us isaac arthur is here

49

00:05:12,150 --> 00:05:10,479

isaac arthur is here he's going to be

50

00:05:15,590 --> 00:05:12,160

with us at the bottom of

51
00:05:17,270 --> 00:05:15,600
the hour we all know about the events of

52
00:05:19,110 --> 00:05:17,280
today

53
00:05:20,310 --> 00:05:19,120
i want to remind everybody that tomorrow

54
00:05:23,029 --> 00:05:20,320
night is another

55
00:05:24,629 --> 00:05:23,039
fader night with open lines all night

56
00:05:28,950 --> 00:05:24,639
long okay so

57
00:05:33,510 --> 00:05:28,960
we will deal with the events of today

58
00:05:37,270 --> 00:05:33,520
tomorrow all right

59
00:05:43,189 --> 00:05:40,710
crazy day and uh yes

60
00:05:44,870 --> 00:05:43,199
i will be speaking about all of it in

61
00:05:48,310 --> 00:05:44,880
just a minute

62
00:05:50,710 --> 00:05:48,320
and uh before we get there i want to

63
00:05:51,990 --> 00:05:50,720

i want to remind everybody uh a few

64

00:05:55,749 --> 00:05:52,000

things i've got to keep the

65

00:05:57,510 --> 00:05:55,759

lights on here at uh fade to black

66

00:05:59,670 --> 00:05:57,520

in the game changer network and we do

67

00:06:03,510 --> 00:05:59,680

that with our sponsors

68

00:06:06,390 --> 00:06:03,520

and uh especially today and this show

69

00:06:08,629 --> 00:06:06,400

going on the air tonight it only happens

70

00:06:12,990 --> 00:06:08,639

with our great sponsors

71

00:06:14,950 --> 00:06:13,000

okay and that is river moon coffee

72

00:06:15,670 --> 00:06:14,960

rivermoonwellness.com that is get the

73

00:06:23,590 --> 00:06:15,680

tea

74

00:06:26,150 --> 00:06:23,600

okay uh billy carson

75

00:06:28,390 --> 00:06:26,160

forbidden knowledge forbidden knowledge

76

00:06:31,670 --> 00:06:28,400

dot tv

77

00:06:34,710 --> 00:06:31,680

very important sponsors of this show

78

00:06:38,870 --> 00:06:34,720

talk stream live bill freeze

79

00:06:42,150 --> 00:06:38,880

very important sponsors of this show

80

00:06:48,150 --> 00:06:42,160

my patriot supply my

81

00:06:51,029 --> 00:06:48,160

patriot supply virtual shield vpn

82

00:06:51,909 --> 00:06:51,039

visit all of our sponsors there's more

83

00:06:56,150 --> 00:06:51,919

but visit

84

00:06:59,189 --> 00:06:56,160

all of our sponsors

85

00:07:02,390 --> 00:06:59,199

all right all right uh

86

00:07:05,990 --> 00:07:02,400

crazy day crazy day i want you to

87

00:07:08,029 --> 00:07:06,000

all take the time uh during the show

88

00:07:10,150 --> 00:07:08,039

after the show uh head over to

89

00:07:10,390 --> 00:07:10,160

jimmychurchradio.com all of our sponsors

90

00:07:14,070 --> 00:07:10,400

are

91

00:07:16,950 --> 00:07:14,080

there click on the links and

92

00:07:17,270 --> 00:07:16,960

uh support the show support our sponsors

93

00:07:19,270 --> 00:07:17,280

uh

94

00:07:20,870 --> 00:07:19,280

they are here because of you the fader

95

00:07:25,189 --> 00:07:20,880

knots

96

00:07:29,029 --> 00:07:25,199

okay all right let's get straight to it

97

00:07:31,670 --> 00:07:29,039

follow me on twitter at j church radio

98

00:07:32,710 --> 00:07:31,680

you can start there at j church radio

99

00:07:34,629 --> 00:07:32,720

the sandbox

100

00:07:37,189 --> 00:07:34,639

any questions or comments anything you

101
00:07:40,230 --> 00:07:37,199
want to join in on the conversation

102
00:07:42,830 --> 00:07:40,240
f2b on twitter any questions during the

103
00:07:45,909 --> 00:07:42,840
show tonight just use hashtag

104
00:07:47,510 --> 00:07:45,919
f2bq all right we've got isaac arthur

105
00:07:48,869 --> 00:07:47,520
with us at the bottom of the hour

106
00:07:50,550 --> 00:07:48,879
we're going to be talking about physics

107
00:07:52,629 --> 00:07:50,560
and science and

108
00:07:55,189 --> 00:07:52,639
the fermi paradox the expansion of the

109
00:07:58,550 --> 00:07:55,199
universe faster than light travel

110
00:08:00,629 --> 00:07:58,560
oh lots of e.t talk all of that

111
00:08:02,150 --> 00:08:00,639
is uh going down tonight with isaac

112
00:08:03,990 --> 00:08:02,160
arthur and i'm gonna tell you right now

113
00:08:05,670 --> 00:08:04,000

i've never been more excited to have a

114

00:08:08,790 --> 00:08:05,680

guest on the show

115

00:08:10,230 --> 00:08:08,800

than i do tonight almost canceled the

116

00:08:12,629 --> 00:08:10,240

show

117

00:08:14,950 --> 00:08:12,639

thought about it and then i thought do

118

00:08:17,990 --> 00:08:14,960

we go to open lines do we

119

00:08:21,430 --> 00:08:18,000

do we move isaac uh forward

120

00:08:24,469 --> 00:08:21,440

in into the month uh do we do that

121

00:08:27,990 --> 00:08:24,479

or do we just do

122

00:08:31,589 --> 00:08:28,000

the show so we're doing the show

123

00:08:36,630 --> 00:08:34,550

a rioting trump mob invaded the united

124

00:08:37,110 --> 00:08:36,640

states capitol building today while the

125

00:08:40,389 --> 00:08:37,120

joint

126
00:08:43,389 --> 00:08:40,399
session was counting the electoral votes

127
00:08:45,190 --> 00:08:43,399
for president-elect joe biden and vice

128
00:08:48,389 --> 00:08:45,200
president-elect

129
00:08:49,110 --> 00:08:48,399
kamala harris the building has been

130
00:08:51,829 --> 00:08:49,120
cleared and

131
00:08:53,910 --> 00:08:51,839
is now secure and the rioters are being

132
00:08:54,949 --> 00:08:53,920
removed from the streets of washington

133
00:08:57,910 --> 00:08:54,959
d.c

134
00:08:58,870 --> 00:08:57,920
and the joint session is now back

135
00:09:01,590 --> 00:08:58,880
underway

136
00:09:02,550 --> 00:09:01,600
tonight hopefully this time to complete

137
00:09:05,750 --> 00:09:02,560
the counting

138
00:09:08,790 --> 00:09:05,760

for biden and harris

139

00:09:11,110 --> 00:09:08,800

next up this all went down yesterday and

140

00:09:13,190 --> 00:09:11,120

concluded today

141

00:09:15,990 --> 00:09:13,200

the great state of georgia georgians

142

00:09:18,710 --> 00:09:16,000

elected john ossoff and the reverend

143

00:09:19,670 --> 00:09:18,720

rafael warnock to the united states

144

00:09:21,509 --> 00:09:19,680

senate

145

00:09:22,710 --> 00:09:21,519

giving the democratic party control of

146

00:09:24,550 --> 00:09:22,720

the house the senate

147

00:09:25,750 --> 00:09:24,560

and the white house for the first time

148

00:09:27,910 --> 00:09:25,760

in a decade

149

00:09:29,750 --> 00:09:27,920

giving president-elect joe biden the

150

00:09:32,630 --> 00:09:29,760

power to potentially enact

151
00:09:34,630 --> 00:09:32,640
sweeping liberal legislation and push

152
00:09:37,590 --> 00:09:34,640
through cabinet nominations without

153
00:09:38,150 --> 00:09:37,600
republican support the senate's party

154
00:09:41,990 --> 00:09:38,160
split

155
00:09:46,150 --> 00:09:42,000
will be 50 50 with vice president-elect

156
00:09:48,870 --> 00:09:46,160
kamala harris breaking the thai votes

157
00:09:51,590 --> 00:09:48,880
dramatic day today dramatic day

158
00:09:54,389 --> 00:09:51,600
yesterday

159
00:09:56,070 --> 00:09:54,399
and then right before the show the drama

160
00:09:59,750 --> 00:09:56,080
continues

161
00:10:03,190 --> 00:09:59,760
twitter has locked president trump's

162
00:10:05,350 --> 00:10:03,200
account for repeatedly violating its

163
00:10:05,829 --> 00:10:05,360

rules and posts about the capitol hill

164

00:10:09,590 --> 00:10:05,839

breach

165

00:10:11,590 --> 00:10:09,600

earlier today and it will remain locked

166

00:10:14,710 --> 00:10:11,600

for 12 hours

167

00:10:15,910 --> 00:10:14,720

and then will further remain locked

168

00:10:19,430 --> 00:10:15,920

until the president

169

00:10:20,069 --> 00:10:19,440

takes down the post the posts in

170

00:10:22,710 --> 00:10:20,079

question

171

00:10:25,030 --> 00:10:22,720

are labeled quote this tweet is no

172

00:10:25,750 --> 00:10:25,040

longer available because it violated the

173

00:10:33,030 --> 00:10:25,760

twitter

174

00:10:36,150 --> 00:10:33,040

that the next step would be a ban placed

175

00:10:38,389 --> 00:10:36,160

on his verified account saying quote

176

00:10:39,670 --> 00:10:38,399

future violations will result in

177

00:10:42,550 --> 00:10:39,680

permanent suspension

178

00:10:44,630 --> 00:10:42,560

of the real donald trump account end

179

00:10:48,949 --> 00:10:44,640

quote that is directly

180

00:10:51,670 --> 00:10:48,959

from twitter and then facebook

181

00:10:52,870 --> 00:10:51,680

also blocked trump from posting on its

182

00:10:56,150 --> 00:10:52,880

platform

183

00:10:59,990 --> 00:10:56,160

for the next 24 hours

184

00:11:04,870 --> 00:11:00,000

trump will also face a 24-hour block

185

00:11:10,310 --> 00:11:08,550

dramatic day let's get the show cracking

186

00:11:14,310 --> 00:11:10,320

happy birthday to today

187

00:11:17,990 --> 00:11:14,320

the fabulous thunderbirds kim wilson

188

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

today is 70 tough enough

189

00:11:21,269 --> 00:11:20,160

love the fabulous thunderbirds jimmy

190

00:11:23,750 --> 00:11:21,279

vaughn

191

00:11:26,470 --> 00:11:23,760

our dead guy's birthday today is sid

192

00:11:29,590 --> 00:11:26,480

barrett 1946 to 2006

193

00:11:33,190 --> 00:11:29,600

died at the age of 60 sid co-founded

194

00:11:35,829 --> 00:11:33,200

the band pink floyd in 1965 barrett

195

00:11:37,509 --> 00:11:35,839

also named the group and was their

196

00:11:39,190 --> 00:11:37,519

original front man and primary

197

00:11:42,389 --> 00:11:39,200

songwriter becoming known

198

00:11:45,990 --> 00:11:42,399

for his english accented singing and

199

00:11:48,949 --> 00:11:46,000

literary influences he was musically

200

00:11:51,430 --> 00:11:48,959

active for only about 10 years with pink

201
00:11:53,509 --> 00:11:51,440
floyd he recorded their debut album

202
00:11:55,590 --> 00:11:53,519
the piper at the gates of dawn and

203
00:11:58,710 --> 00:11:55,600
portions of their second album

204
00:12:01,350 --> 00:11:58,720
a saucer full of secrets pink floyd

205
00:12:05,269 --> 00:12:01,360
recorded several tributes and homages uh

206
00:12:07,990 --> 00:12:05,279
to sid including the 1975

207
00:12:10,790 --> 00:12:08,000
shine on you crazy diamond and of course

208
00:12:14,550 --> 00:12:10,800
the 1979 rock opera

209
00:12:17,750 --> 00:12:14,560
the wall sid died at home in cambridge

210
00:12:21,990 --> 00:12:17,760
on july 7 2006 from

211
00:12:23,910 --> 00:12:22,000
pancreatic cancer he was 60 years old

212
00:12:27,829 --> 00:12:23,920
happy birthday sid barrett on this day

213
00:12:32,230 --> 00:12:27,839

in history otd 1994

214

00:12:35,190 --> 00:12:32,240

skater nancy kerrigan is attacked

215

00:12:36,550 --> 00:12:35,200

two days before the olympic trials on

216

00:12:41,430 --> 00:12:36,560

this day in 1994

217

00:12:46,470 --> 00:12:41,440

fader fact yeah this is a crazy one

218

00:12:49,829 --> 00:12:46,480

it's unbelievable but it's true in 2016

219

00:12:52,069 --> 00:12:49,839

eden a british reality show about

220

00:12:53,430 --> 00:12:52,079

surviving the wilderness of the scottish

221

00:12:56,790 --> 00:12:53,440

highlands

222

00:12:59,829 --> 00:12:56,800

was cancelled after just four

223

00:13:01,750 --> 00:12:59,839

episodes the producers

224

00:13:03,110 --> 00:13:01,760

decided not to tell the contestants that

225

00:13:05,350 --> 00:13:03,120

the show had ended

226

00:13:06,949 --> 00:13:05,360

and allowed them to continue living in

227

00:13:12,150 --> 00:13:06,959

the wilderness

228

00:13:19,430 --> 00:13:16,949

and that that is your fader fact

229

00:13:20,389 --> 00:13:19,440

all right tonight we have on the show

230

00:13:22,069 --> 00:13:20,399

isaac arthur

231

00:13:24,230 --> 00:13:22,079

i've been talking about this show all

232

00:13:27,430 --> 00:13:24,240

week um

233

00:13:29,030 --> 00:13:27,440

having isaac stop by for me is is one of

234

00:13:30,949 --> 00:13:29,040

my guilty pleasures

235

00:13:32,870 --> 00:13:30,959

uh everybody out there knows how i feel

236

00:13:36,030 --> 00:13:32,880

about physics and science and

237

00:13:38,550 --> 00:13:36,040

and isaac in general and of course his

238

00:13:40,629 --> 00:13:38,560

amazingly great youtube channel future

239

00:13:45,590 --> 00:13:40,639

science with isaac arthur

240

00:13:48,790 --> 00:13:45,600

and i i found isaac at the beginning

241

00:13:51,590 --> 00:13:48,800

uh when he first launched uh his

242

00:13:52,790 --> 00:13:51,600

his channel and at that time he had he

243

00:13:55,990 --> 00:13:52,800

had up

244

00:13:58,069 --> 00:13:56,000

uh i you know i don't know maybe a dozen

245

00:13:59,910 --> 00:13:58,079

or two dozen videos

246

00:14:02,470 --> 00:13:59,920

but i watched him over and over again

247

00:14:06,069 --> 00:14:02,480

and it was his original fermi paradox

248

00:14:07,670 --> 00:14:06,079

series and like the first one was like

249

00:14:09,670 --> 00:14:07,680

i can't remember but it seems like it

250

00:14:12,710 --> 00:14:09,680

was two or three hours long

251

00:14:15,829 --> 00:14:12,720

a very very deep

252

00:14:17,430 --> 00:14:15,839

uh video and i listened to it over and

253

00:14:20,550 --> 00:14:17,440

over and over again drove

254

00:14:22,710 --> 00:14:20,560

rita crazy and

255

00:14:25,189 --> 00:14:22,720

i was like i gotta i gotta reach out to

256

00:14:28,310 --> 00:14:25,199

this guy

257

00:14:31,350 --> 00:14:28,320

isaac has got a grip he gets it

258

00:14:34,389 --> 00:14:31,360

he understands it and

259

00:14:35,509 --> 00:14:34,399

and he's been on with this uh for for so

260

00:14:37,189 --> 00:14:35,519

many years now but

261

00:14:38,949 --> 00:14:37,199

this is the thing i have such great

262

00:14:42,389 --> 00:14:38,959

respect for isaac

263

00:14:45,590 --> 00:14:42,399

and uh out there chasing down

264

00:14:47,269 --> 00:14:45,600

physicists and and acquiring knowledge

265

00:14:49,670 --> 00:14:47,279

uh just let me say this so you

266

00:14:49,990 --> 00:14:49,680

understand how important it is for me to

267

00:14:52,710 --> 00:14:50,000

have

268

00:14:53,750 --> 00:14:52,720

isaac on the show is that when you do

269

00:14:56,069 --> 00:14:53,760

what i do

270

00:14:57,590 --> 00:14:56,079

which is you're investigating ufos and

271

00:14:58,069 --> 00:14:57,600

you're wondering about things and that

272

00:15:00,310 --> 00:14:58,079

includes

273

00:15:01,910 --> 00:15:00,320

the past and the in the in the distant

274

00:15:04,790 --> 00:15:01,920

past and us

275

00:15:06,150 --> 00:15:04,800

in our dna and in homo sapiens sapien

276

00:15:08,629 --> 00:15:06,160

there's all of that and then

277

00:15:10,150 --> 00:15:08,639

and then you look to the stars and the

278

00:15:12,470 --> 00:15:10,160

more that you research and you see

279

00:15:16,470 --> 00:15:12,480

something strange in the sky and

280

00:15:21,350 --> 00:15:19,750

the more that you are pushed into the

281

00:15:25,350 --> 00:15:21,360

hard sciences

282

00:15:28,949 --> 00:15:25,360

like i have

283

00:15:31,030 --> 00:15:28,959

and any of you any of you if you ever

284

00:15:33,430 --> 00:15:31,040

want to call my bs

285

00:15:35,110 --> 00:15:33,440

you can reach out to rita right

286

00:15:39,030 --> 00:15:35,120

conference pull her aside

287

00:15:42,470 --> 00:15:39,040

how much does jimmy research

288

00:15:46,470 --> 00:15:42,480

physics and she's going to tell you

289

00:15:48,069 --> 00:15:46,480

it's hours every single day

290

00:15:50,790 --> 00:15:48,079

i'm not a physicist i don't even

291

00:15:54,069 --> 00:15:50,800

understand the math

292

00:15:57,189 --> 00:15:54,079

but i know that there is a connection

293

00:15:57,910 --> 00:15:57,199

here and the more that you push and the

294

00:16:04,550 --> 00:15:57,920

more that you

295

00:16:06,710 --> 00:16:04,560

into these other areas and what you find

296

00:16:09,749 --> 00:16:06,720

when you go to the other side

297

00:16:13,030 --> 00:16:09,759

into the hard sciences is that

298

00:16:15,350 --> 00:16:13,040

they are actually researching the same

299

00:16:17,189 --> 00:16:15,360

things

300

00:16:19,829 --> 00:16:17,199

it's a bizarre thing and in our

301
00:16:22,310 --> 00:16:19,839
community where we have consciousness

302
00:16:23,670 --> 00:16:22,320
and ufos and bigfoot and and the great

303
00:16:26,550 --> 00:16:23,680
pyramid of egypt

304
00:16:27,590 --> 00:16:26,560
we have all of these things

305
00:16:29,350 --> 00:16:27,600
consciousness

306
00:16:30,629 --> 00:16:29,360
and then you go into the hard sciences

307
00:16:34,310 --> 00:16:30,639
and then you find out about

308
00:16:37,350 --> 00:16:34,320
philosophy and where this great divide

309
00:16:38,629 --> 00:16:37,360
is in the great divide

310
00:16:40,550 --> 00:16:38,639
in hard sciences about what

311
00:16:43,910 --> 00:16:40,560
consciousness is and

312
00:16:46,710 --> 00:16:43,920
the opposition to philosophy and the

313
00:16:48,310 --> 00:16:46,720

philosopher physicist and the overlap

314

00:16:51,670 --> 00:16:48,320

and the craziness and

315

00:16:53,430 --> 00:16:51,680

and what galileo thought or newton and

316

00:16:54,949 --> 00:16:53,440

and their thoughts of consciousness and

317

00:16:58,629 --> 00:16:54,959

philosophy and religion

318

00:17:00,949 --> 00:16:58,639

too as well well this is what i do

319

00:17:01,749 --> 00:17:00,959

and and then you go and discover

320

00:17:06,069 --> 00:17:01,759

somebody

321

00:17:08,470 --> 00:17:06,079

like isaac arthur who is speaking

322

00:17:09,429 --> 00:17:08,480

about everything that i'm wondering

323

00:17:13,029 --> 00:17:09,439

about

324

00:17:16,789 --> 00:17:13,039

like isaac gets it he gets it

325

00:17:21,029 --> 00:17:16,799

and so i am able to have a conversation

326

00:17:22,710 --> 00:17:21,039

with somebody ask the questions

327

00:17:24,630 --> 00:17:22,720

that i've been wondering about through

328

00:17:26,230 --> 00:17:24,640

years of research

329

00:17:28,390 --> 00:17:26,240

and that's why isaac arthur is so

330

00:17:28,789 --> 00:17:28,400

important and what was so great about

331

00:17:32,070 --> 00:17:28,799

that

332

00:17:33,590 --> 00:17:32,080

is isaac then gets turned on to fade

333

00:17:35,669 --> 00:17:33,600

to black the fader knots are

334

00:17:37,430 --> 00:17:35,679

introduced to isaac isaac is introduced

335

00:17:40,789 --> 00:17:37,440

into our world

336

00:17:42,390 --> 00:17:40,799

he writes and produces content

337

00:17:45,270 --> 00:17:42,400

on what we talk about every night on

338

00:17:48,630 --> 00:17:45,280

this show right and it's like this

339

00:17:52,630 --> 00:17:48,640

weird amazing

340

00:17:56,150 --> 00:17:52,640

synchronistic relationship right and

341

00:17:57,110 --> 00:17:56,160

and having him on when i know that i can

342

00:17:59,590 --> 00:17:57,120

just sit

343

00:18:01,430 --> 00:17:59,600

and ask whatever and he can turn around

344

00:18:03,270 --> 00:18:01,440

and do the same thing with me

345

00:18:05,270 --> 00:18:03,280

and that is isaac arthur so that's what

346

00:18:08,310 --> 00:18:05,280

we're gonna do tonight on the show

347

00:18:11,669 --> 00:18:08,320

it's very special uh when isaac is here

348

00:18:13,110 --> 00:18:11,679

if you have not yet visited his youtube

349

00:18:16,310 --> 00:18:13,120

channel

350

00:18:17,750 --> 00:18:16,320

you need to go and do it and what i

351
00:18:19,590 --> 00:18:17,760
would do

352
00:18:21,909 --> 00:18:19,600
is i would start at the beginning with

353
00:18:24,549 --> 00:18:21,919
isaac and just just

354
00:18:25,990 --> 00:18:24,559
go through his taking years but but go

355
00:18:29,190 --> 00:18:26,000
through all of his content

356
00:18:32,230 --> 00:18:29,200
in order and and listen to him

357
00:18:32,950 --> 00:18:32,240
develop as not only a researcher but a

358
00:18:35,669 --> 00:18:32,960
presenter

359
00:18:37,669 --> 00:18:35,679
and a producer of content it's been

360
00:18:40,870 --> 00:18:37,679
amazing to see him

361
00:18:42,789 --> 00:18:40,880
rock it to the very tippy top

362
00:18:44,230 --> 00:18:42,799
of not only the science world but the

363
00:18:48,549 --> 00:18:44,240

youtube world

364

00:18:50,630 --> 00:18:48,559

and and a content creator

365

00:18:52,950 --> 00:18:50,640

that is so respected today all right

366

00:18:55,909 --> 00:18:52,960

i've been with isaac from the beginning

367

00:18:59,590 --> 00:18:55,919

and i'm not too sure when when we did

368

00:19:01,750 --> 00:18:59,600

the first show here but it was probably

369

00:19:03,990 --> 00:19:01,760

three or four years ago right after he

370

00:19:06,230 --> 00:19:04,000

started uh future science

371

00:19:08,710 --> 00:19:06,240

and so he's been part of our growth too

372

00:19:11,590 --> 00:19:08,720

as well so isaac arthur is with us

373

00:19:13,350 --> 00:19:11,600

at the bottom of the hour all right all

374

00:19:13,909 --> 00:19:13,360

right i just had to say that i just got

375

00:19:19,669 --> 00:19:13,919

such

376

00:19:20,630 --> 00:19:19,679

and especially after this day today it

377

00:19:23,990 --> 00:19:20,640

was so great

378

00:19:27,430 --> 00:19:24,000

uh to see him and talk to him okay

379

00:19:31,190 --> 00:19:27,440

river moon coffee rivermoonwellness.com

380

00:19:37,990 --> 00:19:34,230

oh man rita

381

00:19:39,990 --> 00:19:38,000

rita this is such a special

382

00:19:47,520 --> 00:19:40,000

pot of coffee i think i'm starting to

383

00:19:47,530 --> 00:19:50,830

[Music]

384

00:19:50,840 --> 00:19:54,870

rivermoonwellness.com

385

00:19:54,880 --> 00:19:59,750

can't we have

386

00:19:59,760 --> 00:20:05,669

can we have just one normal day

387

00:20:05,679 --> 00:20:09,990

is that too much to ask

388

00:20:23,430 --> 00:20:16,149

just one

389

00:20:26,950 --> 00:20:23,440

day i don't even know what that is

390

00:20:32,470 --> 00:20:28,549

i don't i don't even know if i can

391

00:20:39,270 --> 00:20:36,470

but obviously today was

392

00:20:42,630 --> 00:20:39,280

probably the craziest day in american

393

00:20:45,750 --> 00:20:44,310

and we'll have to wait a little longer

394

00:20:50,630 --> 00:20:45,760

won't we

395

00:20:55,510 --> 00:20:50,640

for anything that resembles normal

396

00:20:57,669 --> 00:20:55,520

now we all witnessed the events

397

00:20:59,430 --> 00:20:57,679

as they unfolded live on television and

398

00:21:03,029 --> 00:20:59,440

throughout social media

399

00:21:04,950 --> 00:21:03,039

all day today continues but let me say

400

00:21:11,909 --> 00:21:04,960

this

401
00:21:17,270 --> 00:21:15,510
i would guess that the majority of

402
00:21:21,110 --> 00:21:17,280
americans

403
00:21:24,390 --> 00:21:21,120
have no idea how good

404
00:21:32,950 --> 00:21:28,149
they really don't in fact

405
00:21:36,710 --> 00:21:32,960
there are some right now

406
00:21:46,310 --> 00:21:39,750
that absolutely have no idea how

407
00:21:54,870 --> 00:21:51,270
the nations of the world all of them

408
00:22:01,510 --> 00:21:58,070
they want what we have they

409
00:22:04,630 --> 00:22:01,520
want it because they don't have it

410
00:22:08,870 --> 00:22:04,640
and most of what we have

411
00:22:14,070 --> 00:22:08,880
and what they want is intrinsic

412
00:22:21,909 --> 00:22:17,350
it's freedom it's integrity it's values

413
00:22:29,110 --> 00:22:25,110

these things are what makes us

414

00:22:32,630 --> 00:22:29,120

great makes us creative

415

00:22:33,270 --> 00:22:32,640

it makes us productive and it makes this

416

00:22:40,950 --> 00:22:33,280

place

417

00:22:43,909 --> 00:22:40,960

and everyone knows it the entire world

418

00:22:48,470 --> 00:22:47,510

sure are some great places to visit out

419

00:22:51,510 --> 00:22:48,480

there

420

00:22:55,029 --> 00:22:51,520

some not so great

421

00:22:58,549 --> 00:22:55,039

but most americans have never left

422

00:22:59,669 --> 00:22:58,559

the united states and leaving our

423

00:23:02,470 --> 00:22:59,679

borders

424

00:23:03,510 --> 00:23:02,480

so that you can look back at our great

425

00:23:06,470 --> 00:23:03,520

land

426
00:23:07,669 --> 00:23:06,480
is the only way that anyone can truly

427
00:23:11,430 --> 00:23:07,679
appreciate

428
00:23:15,430 --> 00:23:11,440
how amazing it is to live here

429
00:23:21,510 --> 00:23:18,470
i have visited i have lived

430
00:23:24,470 --> 00:23:21,520
outside of the us

431
00:23:25,830 --> 00:23:24,480
and there's one thing that happens over

432
00:23:30,149 --> 00:23:25,840
and over again

433
00:23:35,190 --> 00:23:33,029
what's it like in america are you an

434
00:23:38,549 --> 00:23:35,200
american

435
00:23:41,909 --> 00:23:38,559
i want to visit america

436
00:23:50,230 --> 00:23:41,919
and of course you'll also get

437
00:23:52,070 --> 00:23:50,240
are the streets really paved with gold

438
00:23:54,149 --> 00:23:52,080

when you hear these questions over and

439

00:23:56,390 --> 00:23:54,159

over again you start to look at the

440

00:23:58,870 --> 00:23:56,400

united states a little differently

441

00:23:59,750 --> 00:23:58,880

and when you return whether it's been a

442

00:24:03,269 --> 00:23:59,760

week

443

00:24:07,510 --> 00:24:03,279

or a couple of years you realize that

444

00:24:11,029 --> 00:24:07,520

yes our streets are indeed

445

00:24:18,070 --> 00:24:14,230

today today the world

446

00:24:21,029 --> 00:24:18,080

watched the land of their dreams the

447

00:24:24,390 --> 00:24:21,039

most respected place on earth

448

00:24:29,029 --> 00:24:24,400

come completely unglued

449

00:24:38,070 --> 00:24:33,669

sure we have differences debate

450

00:24:41,110 --> 00:24:38,080

but in the end we always work it out

451
00:24:41,430 --> 00:24:41,120
we somehow always meet in the middle and

452
00:24:48,870 --> 00:24:41,440
we

453
00:24:52,310 --> 00:24:48,880
this is america

454
00:24:53,990 --> 00:24:52,320
and this is what the rest of the world

455
00:24:57,590 --> 00:24:54,000
desires

456
00:24:58,390 --> 00:24:57,600
because they know that they don't have

457
00:25:04,470 --> 00:24:58,400
it

458
00:25:08,310 --> 00:25:07,590
now over the last four years we have

459
00:25:12,230 --> 00:25:08,320
witnessed

460
00:25:15,990 --> 00:25:12,240
the gradual and sometimes rapid divide

461
00:25:21,029 --> 00:25:18,070
i don't know what everybody's goal is

462
00:25:24,870 --> 00:25:21,039
with this great divide

463
00:25:28,149 --> 00:25:24,880

but half of a great country is

464

00:25:31,669 --> 00:25:28,159

well it's half of

465

00:25:35,269 --> 00:25:31,679

a great country it is

466

00:25:39,430 --> 00:25:35,279

together people

467

00:25:46,310 --> 00:25:42,630

it's being different that makes us the

468

00:25:46,320 --> 00:25:52,470

divided there are no winners here

469

00:26:01,190 --> 00:25:55,590

let it continue and our country will

470

00:26:05,510 --> 00:26:03,830

now i want to be able to travel i want

471

00:26:06,710 --> 00:26:05,520

to be able to travel to other countries

472

00:26:09,750 --> 00:26:06,720

in the future

473

00:26:13,990 --> 00:26:09,760

and feel proud

474

00:26:16,630 --> 00:26:14,000

to flaunt my american accent

475

00:26:17,029 --> 00:26:16,640

knowing that we work things out that we

476
00:26:20,310 --> 00:26:17,039
move

477
00:26:22,630 --> 00:26:20,320
forward and we showed the world that we

478
00:26:25,750 --> 00:26:22,640
are the best place to live

479
00:26:30,070 --> 00:26:25,760
raise a family and have true

480
00:26:39,350 --> 00:26:33,750
we can't do this or accomplish anything

481
00:26:42,390 --> 00:26:39,360
if we hate our neighbors

482
00:26:44,710 --> 00:26:42,400
we have to get back to what got us here

483
00:26:49,669 --> 00:26:44,720
in the first place

484
00:26:56,149 --> 00:26:53,909
if we do it and we will

485
00:26:57,430 --> 00:26:56,159
i know that the next time i travel

486
00:27:01,269 --> 00:26:57,440
abroad

487
00:27:04,950 --> 00:27:01,279
i'll get the best question of them all

488
00:27:08,470 --> 00:27:04,960

are the streets really paved with gold

489

00:27:11,990 --> 00:27:08,480

and my answer will be they

490

00:27:15,110 --> 00:27:13,909

i'm yours jimmy church this is fade to

491

00:27:19,350 --> 00:27:15,120

black

492

00:27:21,510 --> 00:27:19,360

january 6th 2021.

493

00:27:23,990 --> 00:27:21,520

our guest tonight is isaac arthur i want

494

00:27:25,510 --> 00:27:24,000

to remind everybody

495

00:27:27,909 --> 00:27:25,520

that tomorrow night is fader night with

496

00:27:29,510 --> 00:27:27,919

open lines all night long

497

00:27:32,710 --> 00:27:29,520

take a quick break and i'll be right

498

00:27:38,389 --> 00:27:32,720

back with the one and only

499

00:27:41,750 --> 00:27:40,789

all right everybody relax it's time to

500

00:27:44,950 --> 00:27:41,760

escape

501
00:27:46,950 --> 00:27:44,960
let's do this man and the game changer

502
00:27:49,990 --> 00:27:46,960
network and kgra

503
00:27:53,389 --> 00:27:50,000
the planet follow me on twitter i j

504
00:27:55,110 --> 00:27:53,399
church radio email is jimmy

505
00:28:02,540 --> 00:27:55,120
jimmychurchradio.com

506
00:28:25,590 --> 00:28:02,550
stay with me i'll be right back

507
00:28:27,750 --> 00:28:25,600
[Music]

508
00:28:29,990 --> 00:28:27,760
this is nicole church daughter of you

509
00:28:32,310 --> 00:28:30,000
know who and you're listening to fade to

510
00:28:36,389 --> 00:28:32,320
black on jimmychurchradio.com and the

511
00:28:42,789 --> 00:28:38,630
you're listening to jimmy church fade to

512
00:28:45,980 --> 00:28:45,029
fate to black will now pause for alien

513
00:28:47,350 --> 00:28:45,990

identification

514

00:28:50,630 --> 00:28:47,360

[Music]

515

00:28:54,310 --> 00:28:50,640

the station that talks the net ktra

516

00:28:58,470 --> 00:28:56,549

introducing the game changer blend from

517

00:29:00,950 --> 00:28:58,480

river moon coffee that delivers a

518

00:29:02,310 --> 00:29:00,960

customized blend made specifically for

519

00:29:05,510 --> 00:29:02,320

the fader knots

520

00:29:08,470 --> 00:29:05,520

if the game is rigged change the game

521

00:29:10,389 --> 00:29:08,480

it's a boulder cup with some bite game

522

00:29:12,710 --> 00:29:10,399

changer is the coffee of choice for

523

00:29:13,830 --> 00:29:12,720

those that prefer an organic dark roast

524

00:29:17,269 --> 00:29:13,840

that is slightly

525

00:29:19,830 --> 00:29:17,279

lighter and milder but it's still dark

526
00:29:20,789 --> 00:29:19,840
with wild notes of pecans and chocolate

527
00:29:23,350 --> 00:29:20,799
with a rich

528
00:29:25,430 --> 00:29:23,360
balanced full-bodied cup that is roasted

529
00:29:26,070 --> 00:29:25,440
to perfection for a great coffee to

530
00:29:28,789 --> 00:29:26,080
start your

531
00:29:30,549 --> 00:29:28,799
day as an after dinner coffee or

532
00:29:32,470 --> 00:29:30,559
anywhere in between

533
00:29:35,190 --> 00:29:32,480
artisan small batch roasted to

534
00:29:37,830 --> 00:29:35,200
perfection usda certified organic

535
00:29:40,590 --> 00:29:37,840
all river moon coffee is freshly roasted

536
00:29:42,230 --> 00:29:40,600
and packaged in the usa just go to

537
00:29:44,389 --> 00:29:42,240
rivermooncoffee.com or click on the

538
00:29:45,110 --> 00:29:44,399

banners over on our site and use the

539

00:29:50,830 --> 00:29:45,120

promo code

540

00:29:54,870 --> 00:29:50,840

f2b blend for 15 off of your order today

541

00:29:57,909 --> 00:29:54,880

rivermooncoffee.com go back lee tappy

542

00:30:02,909 --> 00:29:57,919

this is the only way forward this

543

00:30:05,190 --> 00:30:02,919

is made to black make contact

544

00:30:06,870 --> 00:30:05,200

kgraradio.com

545

00:30:09,269 --> 00:30:06,880

this is jimmy church of fade to black

546

00:30:11,909 --> 00:30:09,279

and you can get our podcast for just

547

00:30:13,990 --> 00:30:11,919

two dollars per month all you have to do

548

00:30:17,190 --> 00:30:14,000

is click on the podcast banner

549

00:30:19,909 --> 00:30:17,200

over at jimmychurchradio.com

550

00:30:21,110 --> 00:30:19,919

hi folks it's trembling times and fears

551
00:30:23,350 --> 00:30:21,120
pushing emotions

552
00:30:24,789 --> 00:30:23,360
which in turn pushes health the wrong

553
00:30:26,149 --> 00:30:24,799
direction do you ever get an ache

554
00:30:28,789 --> 00:30:26,159
because life is uneasy

555
00:30:30,710 --> 00:30:28,799
try life change tea get the tea.com life

556
00:30:31,430 --> 00:30:30,720
change tea works on your digestive tract

557
00:30:33,830 --> 00:30:31,440
helping to move

558
00:30:35,350 --> 00:30:33,840
food through quicker and comfortably so

559
00:30:37,110 --> 00:30:35,360
your health is spot on

560
00:30:39,190 --> 00:30:37,120
life change team may not help with world

561
00:30:40,630 --> 00:30:39,200
issues but it will help with your

562
00:30:42,630 --> 00:30:40,640
digestive issues

563
00:30:44,230 --> 00:30:42,640

a glass a day helps keep the intruders

564

00:30:46,870 --> 00:30:44,240

away so

565

00:30:49,110 --> 00:30:46,880

change your life today log on to get the

566

00:30:51,669 --> 00:30:49,120

tea.com that's get the

567

00:30:53,750 --> 00:30:51,679

dot com if your health game is off get

568

00:30:56,230 --> 00:30:53,760

on by ordering life change tea

569

00:30:57,830 --> 00:30:56,240

get the tea.com and while you're on our

570

00:30:59,990 --> 00:30:57,840

site look around at the great

571

00:31:01,190 --> 00:31:00,000

non-gmo organic supplements and if

572

00:31:03,590 --> 00:31:01,200

you're a sales shopper

573

00:31:04,389 --> 00:31:03,600

go to our specials page and see what's

574

00:31:06,070 --> 00:31:04,399

for you

575

00:31:07,590 --> 00:31:06,080

i've been drinking the tea for 12 years

576

00:31:08,549 --> 00:31:07,600

and i'm sure glad for its health

577

00:31:11,430 --> 00:31:08,559

benefits

578

00:31:12,149 --> 00:31:11,440

again that's get the tea dot com get the

579

00:31:17,750 --> 00:31:12,159

tea

580

00:31:19,590 --> 00:31:17,760

fader knots when you think about the

581

00:31:21,509 --> 00:31:19,600

future of our country and where we're

582

00:31:22,389 --> 00:31:21,519

headed do you wonder about the food

583

00:31:26,549 --> 00:31:22,399

supply

584

00:31:28,710 --> 00:31:26,559

chain could be disastrous

585

00:31:30,950 --> 00:31:28,720

and they usually occur with little

586

00:31:31,990 --> 00:31:30,960

warning that's why the smartest thing

587

00:31:35,190 --> 00:31:32,000

you can do today

588

00:31:37,509 --> 00:31:35,200

is to stockpile emergency food water

589

00:31:38,630 --> 00:31:37,519

and other essentials i personally

590

00:31:40,789 --> 00:31:38,640

recommend my

591

00:31:43,269 --> 00:31:40,799

patriot supply they're the nation's

592

00:31:45,509 --> 00:31:43,279

largest emergency preparedness company

593

00:31:46,710 --> 00:31:45,519

serving millions of customers for more

594

00:31:49,029 --> 00:31:46,720

than a decade

595

00:31:51,669 --> 00:31:49,039

in fact they're the only source my

596

00:31:54,389 --> 00:31:51,679

family trusts for our preparedness plan

597

00:31:55,669 --> 00:31:54,399

you should too right now save twenty

598

00:31:57,909 --> 00:31:55,679

percent off a full

599

00:31:59,830 --> 00:31:57,919

four week supply of delicious meals that

600

00:32:03,190 --> 00:31:59,840

provide two thousand calories

601
00:32:06,070 --> 00:32:03,200
a day saving 20 helps too doesn't it

602
00:32:08,310 --> 00:32:06,080
especially now so go to prepare with

603
00:32:11,590 --> 00:32:08,320
jimmy.com and get ready

604
00:32:12,870 --> 00:32:11,600
that's prepare with jimmy.com there's no

605
00:32:16,070 --> 00:32:12,880
time to lose

606
00:32:16,080 --> 00:32:21,190
nine out of ten geneticists agree

607
00:32:28,070 --> 00:32:24,950
fade to black is not

608
00:32:32,149 --> 00:32:28,080
your father's radio show on the

609
00:32:36,230 --> 00:32:32,159
game changer radio network and kgra

610
00:32:36,789 --> 00:32:36,240
the planet hi this is rob reiner from

611
00:32:39,149 --> 00:32:36,799
anvil

612
00:32:41,430 --> 00:32:39,159
and you're listening to

613
00:32:44,310 --> 00:32:41,440

jimmychurchradio.com

614

00:32:58,010 --> 00:32:44,320

what's up i'm chris what up this is

615

00:32:58,020 --> 00:33:01,990

[Music]

616

00:33:05,990 --> 00:33:03,509

all right welcome back fade to black i'm

617

00:33:08,149 --> 00:33:06,000

your host jimmy church

618

00:33:12,389 --> 00:33:08,159

and the game changer network and kg are

619

00:33:17,509 --> 00:33:14,710

isaac arthur that's all i gotta say

620

00:33:19,990 --> 00:33:17,519

everybody knows isaac these days

621

00:33:20,710 --> 00:33:20,000

isaac other tomorrow nights is another

622

00:33:22,470 --> 00:33:20,720

fader night

623

00:33:25,350 --> 00:33:22,480

with open lines all night long but

624

00:33:26,710 --> 00:33:25,360

tonight isaac joins us for another

625

00:33:28,070 --> 00:33:26,720

in-depth conversation we're going to

626

00:33:29,269 --> 00:33:28,080

talk about measurement we're going to

627

00:33:32,549 --> 00:33:29,279

talk about observation

628

00:33:34,310 --> 00:33:32,559

entanglement the fermi paradox and i'm

629

00:33:35,190 --> 00:33:34,320

going to ask the question what could

630

00:33:37,110 --> 00:33:35,200

possibly go

631

00:33:40,789 --> 00:33:37,120

faster than the speed of light i know

632

00:33:44,950 --> 00:33:43,190

isaac is one of is the host of science

633

00:33:45,990 --> 00:33:44,960

and futurism with isaac arthur on

634

00:33:50,470 --> 00:33:46,000

youtube he's

635

00:33:52,789 --> 00:33:50,480

currently over 600 000 subscribers

636

00:33:55,190 --> 00:33:52,799

covering i remember the days covering

637

00:33:57,509 --> 00:33:55,200

topics like colonizing our solar system

638

00:33:59,669 --> 00:33:57,519

interstellar travel the fermi paradox

639

00:34:01,750 --> 00:33:59,679

artificial intelligence and other topics

640

00:34:04,470 --> 00:34:01,760

representing possible future paths

641

00:34:06,310 --> 00:34:04,480

and challenges for humanity isaac

642

00:34:08,389 --> 00:34:06,320

received his degree in physics from kent

643

00:34:08,869 --> 00:34:08,399

state university graduating top of his

644

00:34:11,750 --> 00:34:08,879

class

645

00:34:13,349 --> 00:34:11,760

at the prime young age of 20. remained

646

00:34:14,710 --> 00:34:13,359

there for graduate studies before

647

00:34:16,069 --> 00:34:14,720

joining the united states army and

648

00:34:18,550 --> 00:34:16,079

serving in iraq

649

00:34:20,069 --> 00:34:18,560

he also served as a civilian researcher

650

00:34:23,510 --> 00:34:20,079

at the air force institute

651
00:34:25,829 --> 00:34:23,520
of technology in dayton ohio which means

652
00:34:26,950 --> 00:34:25,839
he's a disinformation agent after the

653
00:34:29,669 --> 00:34:26,960
military

654
00:34:34,869 --> 00:34:29,679
he returned home to ohio and serves as

655
00:34:38,230 --> 00:34:34,879
the chairman of the board of elections

656
00:34:39,829 --> 00:34:38,240
oh we're not working on his youtube

657
00:34:40,790 --> 00:34:39,839
channel i'd like to welcome back to fade

658
00:34:43,510 --> 00:34:40,800
to black

659
00:34:44,710 --> 00:34:43,520
isaac arthur isaac how are you man i'm

660
00:34:46,710 --> 00:34:44,720
doing great jimmy thanks for having me

661
00:34:47,109 --> 00:34:46,720
on again man that was a good uh that was

662
00:34:49,589 --> 00:34:47,119
a good

663
00:34:50,149 --> 00:34:49,599

round of laps right there i i appreciate

664

00:34:53,750 --> 00:34:50,159

all of that

665

00:34:57,750 --> 00:34:53,760

isaac um uh look

666

00:35:01,430 --> 00:34:57,760

uh today was today that's behind us

667

00:35:05,190 --> 00:35:01,440

uh let's just talk all right

668

00:35:08,550 --> 00:35:05,200

are you down absolutely all right

669

00:35:10,230 --> 00:35:08,560

oh man okay uh

670

00:35:12,310 --> 00:35:10,240

i need these uh next two and a half

671

00:35:12,870 --> 00:35:12,320

hours and i can see that you're drinking

672

00:35:15,430 --> 00:35:12,880

uh

673

00:35:16,870 --> 00:35:15,440

a pretty hefty cup of coffee there

674

00:35:18,150 --> 00:35:16,880

you're good to go i want to let

675

00:35:21,750 --> 00:35:18,160

everybody know i can see

676

00:35:24,150 --> 00:35:21,760

isaac he's sitting um in his vast

677

00:35:25,829 --> 00:35:24,160

uh office and library he's got all of

678

00:35:28,470 --> 00:35:25,839

his study materials there

679

00:35:30,069 --> 00:35:28,480

he's got a nice wooden big wooden desk

680

00:35:31,910 --> 00:35:30,079

you got a chair behind you you've got a

681

00:35:35,349 --> 00:35:31,920

great audio set up

682

00:35:37,190 --> 00:35:35,359

um it's exactly like somebody that has a

683

00:35:39,829 --> 00:35:37,200

program called future science

684

00:35:41,270 --> 00:35:39,839

should have isaac very impressive um

685

00:35:44,310 --> 00:35:41,280

really quick before i

686

00:35:47,349 --> 00:35:44,320

i it's been i found out today

687

00:35:48,150 --> 00:35:47,359

and i know uh this may surprise you it's

688

00:35:51,349 --> 00:35:48,160

been like nine

689

00:35:53,270 --> 00:35:51,359

months since you've been on the show

690

00:35:55,270 --> 00:35:53,280

you're kidding me yeah right seems like

691

00:35:57,510 --> 00:35:55,280

it was didn't we do something

692

00:35:59,750 --> 00:35:57,520

oh it was coast coast yeah we did coast

693

00:36:01,190 --> 00:35:59,760

to coast and even that was a while ago

694

00:36:02,870 --> 00:36:01,200

yeah it was back in that was actually

695

00:36:06,550 --> 00:36:02,880

right around yeah

696

00:36:08,230 --> 00:36:06,560

exactly so um if we think about all of

697

00:36:09,670 --> 00:36:08,240

that uh it's been nine months since

698

00:36:12,630 --> 00:36:09,680

you've been on the show

699

00:36:13,109 --> 00:36:12,640

uh since then big changes in your life

700

00:36:16,630 --> 00:36:13,119

you're

701
00:36:17,190 --> 00:36:16,640
now domesticated i am i got married to

702
00:36:20,069 --> 00:36:17,200
uh my

703
00:36:21,109 --> 00:36:20,079
longtime friend sarah fowler ortho and

704
00:36:23,910 --> 00:36:21,119
uh we actually just

705
00:36:25,190 --> 00:36:23,920
swore her in as a state legislature on

706
00:36:28,710 --> 00:36:25,200
monday

707
00:36:31,190 --> 00:36:28,720
how incredible is that right and uh

708
00:36:32,710 --> 00:36:31,200
uh listen i i i i don't want to

709
00:36:35,750 --> 00:36:32,720
embarrass you

710
00:36:39,430 --> 00:36:35,760
but it it for me um

711
00:36:40,710 --> 00:36:39,440
uh we're friends but to see your post on

712
00:36:44,790 --> 00:36:40,720
facebook

713
00:36:46,790 --> 00:36:44,800

of married life doing things right

714

00:36:48,630 --> 00:36:46,800

building a shed in the backyard whatever

715

00:36:51,510 --> 00:36:48,640

it is right

716

00:36:53,030 --> 00:36:51,520

and i think you did build a shed didn't

717

00:36:54,710 --> 00:36:53,040

we we wrote a shed in the greenhouse

718

00:36:56,230 --> 00:36:54,720

yeah that's right that's right i was

719

00:36:57,910 --> 00:36:56,240

making that up but now that i think

720

00:36:59,430 --> 00:36:57,920

about it that actually happened

721

00:37:01,990 --> 00:36:59,440

that wasn't rebuilt the greenhouse after

722

00:37:05,589 --> 00:37:02,000

it blew over

723

00:37:07,510 --> 00:37:05,599

um so uh everything's good life is good

724

00:37:09,190 --> 00:37:07,520

life is is doing amazing i feel almost

725

00:37:10,630 --> 00:37:09,200

bad because 2020 was such a rough year

726

00:37:12,310 --> 00:37:10,640

for the elves but uh

727

00:37:14,470 --> 00:37:12,320

yeah it was probably the best year of my

728

00:37:17,430 --> 00:37:14,480

life so yeah yeah i know

729

00:37:18,630 --> 00:37:17,440

i know and and so many out there are are

730

00:37:20,790 --> 00:37:18,640

just not doing well

731

00:37:23,030 --> 00:37:20,800

and of course our family just got over

732

00:37:26,630 --> 00:37:23,040

over-covered i got over-covered

733

00:37:28,630 --> 00:37:26,640

uh i'm still not 100 percent uh

734

00:37:29,829 --> 00:37:28,640

my family got hit uh the day before

735

00:37:32,550 --> 00:37:29,839

thanksgiving

736

00:37:33,270 --> 00:37:32,560

and uh here we are you know so you know

737

00:37:36,310 --> 00:37:33,280

that's uh

738

00:37:39,030 --> 00:37:36,320

six weeks ago five weeks ago and

739

00:37:39,510 --> 00:37:39,040

it it was rough and i know what we went

740

00:37:41,270 --> 00:37:39,520

through

741

00:37:43,910 --> 00:37:41,280

and and the rest of the country people

742

00:37:46,870 --> 00:37:43,920

have lost family members and friends and

743

00:37:49,190 --> 00:37:46,880

um it's uh it's a very harsh thing to go

744

00:37:53,109 --> 00:37:49,200

through it's just been the craziest

745

00:37:56,390 --> 00:37:53,119

year ever um congratulations on 600

746

00:37:58,550 --> 00:37:56,400

000 subscribers um and that that

747

00:38:00,150 --> 00:37:58,560

is a big congratulations did you ever

748

00:38:04,069 --> 00:38:00,160

think that i remember

749

00:38:05,510 --> 00:38:04,079

uh you may remember this i don't know

750

00:38:07,270 --> 00:38:05,520

how long ago it was

751
00:38:08,710 --> 00:38:07,280
i remember when you got to two hundred

752
00:38:09,589 --> 00:38:08,720
thousand and we talked about it on the

753
00:38:13,349 --> 00:38:09,599
show

754
00:38:17,750 --> 00:38:14,950
time just goes going on didn't you do

755
00:38:20,950 --> 00:38:17,760
your 10th anniversary last year yeah

756
00:38:22,310 --> 00:38:20,960
we did in december last month yeah yeah

757
00:38:25,430 --> 00:38:22,320
and so

758
00:38:29,349 --> 00:38:25,440
uh but did you imagine

759
00:38:32,470 --> 00:38:29,359
at the start of uh right

760
00:38:33,589 --> 00:38:32,480
no i still remember when i got a little

761
00:38:35,270 --> 00:38:33,599
email from youtube

762
00:38:36,630 --> 00:38:35,280
saying congratulations you've got a

763
00:38:42,310 --> 00:38:36,640

subscriber

764

00:38:44,230 --> 00:38:42,320

and and it was a constant shock i never

765

00:38:46,630 --> 00:38:44,240

thought the channel would get that big

766

00:38:47,910 --> 00:38:46,640

and uh it's just amazing to find out so

767

00:38:49,190 --> 00:38:47,920

many people have a shared interest in

768

00:38:50,870 --> 00:38:49,200

those topics

769

00:38:51,910 --> 00:38:50,880

um and actually kind of bad for because

770

00:38:53,349 --> 00:38:51,920

i never thought there'd be that many

771

00:38:54,390 --> 00:38:53,359

people i feel like i was

772

00:38:55,430 --> 00:38:54,400

being a little bit unfair everybody

773

00:38:57,109 --> 00:38:55,440

always assumed there wasn't that much

774

00:39:01,589 --> 00:38:57,119

interest in these topics

775

00:39:04,870 --> 00:39:01,599

did the uh did the thought ever

776

00:39:05,910 --> 00:39:04,880

occur to you i'm sure it has that you

777

00:39:09,750 --> 00:39:05,920

might

778

00:39:10,230 --> 00:39:09,760

run out of material it was a boy earlier

779

00:39:13,430 --> 00:39:10,240

on

780

00:39:15,270 --> 00:39:13,440

the future is there's always so much

781

00:39:17,190 --> 00:39:15,280

more of it

782

00:39:19,349 --> 00:39:17,200

we never seem to run out of topics we

783

00:39:21,910 --> 00:39:19,359

get more of them in all the time

784

00:39:23,349 --> 00:39:21,920

uh sometimes we have we do is on topic

785

00:39:25,750 --> 00:39:23,359

we're looking at more depth but

786

00:39:26,870 --> 00:39:25,760

uh we've never even come close to any

787

00:39:28,310 --> 00:39:26,880

other topics every time i think we're

788

00:39:29,670 --> 00:39:28,320

getting close you know we'll let a point

789

00:39:30,550 --> 00:39:29,680

see what people feel like looking at and

790

00:39:32,630 --> 00:39:30,560

there'll be

791

00:39:33,990 --> 00:39:32,640

20 new topics on there that we've never

792

00:39:35,109 --> 00:39:34,000

thought about doing that are all good

793

00:39:38,150 --> 00:39:35,119

topics so

794

00:39:39,829 --> 00:39:38,160

between now and

795

00:39:41,349 --> 00:39:39,839

uh infinity the heat death of the

796

00:39:44,710 --> 00:39:41,359

universe yeah

797

00:39:48,069 --> 00:39:44,720

right because uh and what fascinates me

798

00:39:48,390 --> 00:39:48,079

about the hard sciences is that today i

799

00:39:51,030 --> 00:39:48,400

think

800

00:39:52,950 --> 00:39:51,040

more and more people appreciate it and

801
00:39:55,109 --> 00:39:52,960
they want the content

802
00:39:58,310 --> 00:39:55,119
so there are content providers out there

803
00:40:01,510 --> 00:39:58,320
whether it's an actual professor

804
00:40:04,710 --> 00:40:01,520
or or or television or what have you

805
00:40:07,109 --> 00:40:04,720
but that every day now in the news

806
00:40:07,990 --> 00:40:07,119
or in the science community it seems

807
00:40:10,550 --> 00:40:08,000
like there

808
00:40:11,910 --> 00:40:10,560
is breaking news and discoveries nearly

809
00:40:15,990 --> 00:40:11,920
on a daily basis

810
00:40:17,829 --> 00:40:16,000
i mean dramatic big leaps forward

811
00:40:19,670 --> 00:40:17,839
i wish they'd report on it more inside

812
00:40:20,870 --> 00:40:19,680
while the more major networks were new

813
00:40:22,710 --> 00:40:20,880

as it sometimes fears there's such a

814

00:40:24,309 --> 00:40:22,720

focus on things that

815

00:40:26,630 --> 00:40:24,319

we forget about all the awesome stuff

816

00:40:28,150 --> 00:40:26,640

going on and you're like spacex gets

817

00:40:29,349 --> 00:40:28,160

news but there are so many other i mean

818

00:40:32,069 --> 00:40:29,359

spacex is amazing

819

00:40:33,109 --> 00:40:32,079

but there's so much discovery so much

820

00:40:35,109 --> 00:40:33,119

new

821

00:40:36,390 --> 00:40:35,119

cool awesome you know life improving

822

00:40:37,829 --> 00:40:36,400

things out there

823

00:40:39,589 --> 00:40:37,839

and you could fill up in town use

824

00:40:40,309 --> 00:40:39,599

program with them every single day and

825

00:40:41,430 --> 00:40:40,319

yet

826

00:40:42,630 --> 00:40:41,440

for the most part people don't get to

827

00:40:43,990 --> 00:40:42,640

hear about them and i do think that's

828

00:40:44,870 --> 00:40:44,000

the least part of it you know when you

829

00:40:46,550 --> 00:40:44,880

go into a year

830

00:40:48,870 --> 00:40:46,560

it has been a few we all know it's been

831

00:40:50,470 --> 00:40:48,880

a rough year but at the same time part

832

00:40:51,589 --> 00:40:50,480

of that's part of the two headspace you

833

00:40:52,470 --> 00:40:51,599

know if you're hearing nothing but bad

834

00:40:54,230 --> 00:40:52,480

news

835

00:40:55,910 --> 00:40:54,240

it feels like a crappy year on the other

836

00:40:57,270 --> 00:40:55,920

hand if you've got good news coming in

837

00:40:58,790 --> 00:40:57,280

and has been a lot of good news this

838

00:41:00,069 --> 00:40:58,800

year we've made improvements towards

839

00:41:01,589 --> 00:41:00,079

fixing cancer we've made

840

00:41:03,190 --> 00:41:01,599

improvements towards getting that first

841

00:41:04,390 --> 00:41:03,200

moon base that is really back on the

842

00:41:06,069 --> 00:41:04,400

table now with that

843

00:41:07,829 --> 00:41:06,079

you know the rocket launch which ended

844

00:41:09,510 --> 00:41:07,839

with an explosion but it was uh

845

00:41:10,790 --> 00:41:09,520

a very successful one anyway it's hard

846

00:41:13,430 --> 00:41:10,800

to explain to people sometimes how could

847

00:41:15,349 --> 00:41:13,440

blow up on the pad and we'd say yeah

848

00:41:18,309 --> 00:41:15,359

that was uh that was especially that

849

00:41:20,829 --> 00:41:18,319

moon base in a decade

850

00:41:23,030 --> 00:41:20,839

2024 is supposed to be the year we're in

851
00:41:24,950 --> 00:41:23,040
2021

852
00:41:26,230 --> 00:41:24,960
three years we're gonna have americans

853
00:41:27,750 --> 00:41:26,240
back on the moon and

854
00:41:29,829 --> 00:41:27,760
that would be an amazing thing yeah

855
00:41:31,510 --> 00:41:29,839
amazing amazing and there's another part

856
00:41:34,870 --> 00:41:31,520
to this too as well

857
00:41:37,829 --> 00:41:34,880
when you take um the

858
00:41:39,190 --> 00:41:37,839
um we'll discuss the fermi paradox later

859
00:41:41,990 --> 00:41:39,200
but when you

860
00:41:43,670 --> 00:41:42,000
take the basic definition of the fermi

861
00:41:46,710 --> 00:41:43,680
paradox

862
00:41:48,790 --> 00:41:46,720
so many stop right there

863
00:41:50,390 --> 00:41:48,800

right just with the definition and they

864

00:41:53,510 --> 00:41:50,400

think that's all that

865

00:41:56,790 --> 00:41:53,520

there is you've made a living

866

00:41:58,309 --> 00:41:56,800

off of the fermi paradox a friend who

867

00:41:59,829 --> 00:41:58,319

runs a show it also talks about the

868

00:42:01,109 --> 00:41:59,839

topic quite a lot too and he and i

869

00:42:03,589 --> 00:42:01,119

really actually found ourselves

870

00:42:05,990 --> 00:42:03,599

overlapping much on top no it is

871

00:42:07,990 --> 00:42:06,000

well it's a huge conversation there is a

872

00:42:09,270 --> 00:42:08,000

gigantic universe out there that

873

00:42:10,950 --> 00:42:09,280

feels like it should be populated with

874

00:42:12,470 --> 00:42:10,960

life all over the place and yet either

875

00:42:13,670 --> 00:42:12,480

it isn't or it isn't the way we tend to

876

00:42:16,470 --> 00:42:13,680

expect it to be

877

00:42:17,910 --> 00:42:16,480

and that is you know that has got to be

878

00:42:19,190 --> 00:42:17,920

one of the biggest mysteries going on

879

00:42:20,550 --> 00:42:19,200

right now for us all so

880

00:42:22,150 --> 00:42:20,560

there's plenty to talk about on it you

881

00:42:23,990 --> 00:42:22,160

know well and the way that you

882

00:42:26,630 --> 00:42:24,000

originally broke it down

883

00:42:27,190 --> 00:42:26,640

um it was it was pretty interesting for

884

00:42:32,069 --> 00:42:27,200

me i

885

00:42:33,349 --> 00:42:32,079

actually uh your original fermi paradox

886

00:42:37,190 --> 00:42:33,359

part one

887

00:42:41,190 --> 00:42:37,200

which was a very complex show by the way

888

00:42:43,109 --> 00:42:41,200

um but i i wrote out the list

889

00:42:44,309 --> 00:42:43,119

right you know point for point i write

890

00:42:46,630 --> 00:42:44,319

down the list

891

00:42:47,829 --> 00:42:46,640

and and i took a look at that and

892

00:42:51,030 --> 00:42:47,839

thought to myself

893

00:42:54,309 --> 00:42:51,040

each one of these very brief statements

894

00:42:57,589 --> 00:42:54,319

from isaac can last

895

00:42:58,470 --> 00:42:57,599

for a week of discussion right

896

00:43:00,069 --> 00:42:58,480

you understand what i'm saying

897

00:43:01,589 --> 00:43:00,079

absolutely yeah i think most of those

898

00:43:03,829 --> 00:43:01,599

ones we have ended up doing an episode

899

00:43:05,349 --> 00:43:03,839

on them a couple other whole series

900

00:43:06,950 --> 00:43:05,359

and in each of those cases we had to

901
00:43:07,430 --> 00:43:06,960
triple our stuff out of the script you

902
00:43:09,589 --> 00:43:07,440
know

903
00:43:10,829 --> 00:43:09,599
yeah exactly and that's got to be fun

904
00:43:13,750 --> 00:43:10,839
for you

905
00:43:17,190 --> 00:43:13,760
um in

906
00:43:20,550 --> 00:43:17,200
that um when you

907
00:43:23,750 --> 00:43:20,560
uh start at the top of an indexed

908
00:43:26,950 --> 00:43:23,760
list like that are you writing

909
00:43:28,950 --> 00:43:26,960
from thought are you writing from

910
00:43:30,309 --> 00:43:28,960
thought are you researching and writing

911
00:43:31,750 --> 00:43:30,319
at the same time

912
00:43:33,430 --> 00:43:31,760
i mean i guess once the research is done

913
00:43:35,190 --> 00:43:33,440

in the background but usually

914

00:43:36,309 --> 00:43:35,200

when i sit down to write the only reason

915

00:43:37,510 --> 00:43:36,319

i'll interrupt that there's there's

916

00:43:39,190 --> 00:43:37,520

usually three things that will get me

917

00:43:42,309 --> 00:43:39,200

away from the keyboard

918

00:43:43,990 --> 00:43:42,319

one is a power outage uh two is when i

919

00:43:45,270 --> 00:43:44,000

coffee runs out and three is if i need

920

00:43:45,589 --> 00:43:45,280

to switch over to wikipedia to double

921

00:43:47,829 --> 00:43:45,599

check

922

00:43:49,990 --> 00:43:47,839

some specific factoid like you know what

923

00:43:51,750 --> 00:43:50,000

is the luminosity of a given star

924

00:43:53,589 --> 00:43:51,760

right how many meters is it to pluto

925

00:43:55,430 --> 00:43:53,599

well you wanna be kind of exact but

926
00:43:56,550 --> 00:43:55,440
for the most part you know if the

927
00:43:58,470 --> 00:43:56,560
script's not going well and i had to

928
00:43:59,670 --> 00:43:58,480
stop doing kind of major research on it

929
00:44:01,750 --> 00:43:59,680
that's where i delete the script and

930
00:44:02,950 --> 00:44:01,760
start back over again it's just my style

931
00:44:07,030 --> 00:44:02,960
of writing so

932
00:44:09,990 --> 00:44:07,040
and the reason why because i noticed uh

933
00:44:10,470 --> 00:44:10,000
very early on and of course i see it

934
00:44:13,589 --> 00:44:10,480
episode

935
00:44:18,710 --> 00:44:13,599
the

936
00:44:20,390 --> 00:44:18,720
right it doesn't sound like it's coming

937
00:44:23,910 --> 00:44:20,400
from three different writers

938
00:44:26,630 --> 00:44:23,920

or you took a a a a a

939

00:44:27,270 --> 00:44:26,640

a week break in between you know it's

940

00:44:30,150 --> 00:44:27,280

it's all

941

00:44:32,069 --> 00:44:30,160

one piece and it flows do you do that by

942

00:44:33,510 --> 00:44:32,079

intention

943

00:44:35,190 --> 00:44:33,520

i think it's whether that's the style

944

00:44:35,670 --> 00:44:35,200

i'd go with but we have some exceptions

945

00:44:37,030 --> 00:44:35,680

like

946

00:44:38,470 --> 00:44:37,040

we have a lot of editors who help out on

947

00:44:40,150 --> 00:44:38,480

the show checking things through or

948

00:44:41,109 --> 00:44:40,160

making sure i'm not making nonsense

949

00:44:42,470 --> 00:44:41,119

comments

950

00:44:43,670 --> 00:44:42,480

and sometimes they have a good idea they

951
00:44:44,870 --> 00:44:43,680
want to insult the script and the

952
00:44:47,270 --> 00:44:44,880
biggest problem is i can try to figure

953
00:44:50,069 --> 00:44:47,280
out where we squeeze it in here because

954
00:44:51,190 --> 00:44:50,079
everything just goes a b c d there's no

955
00:44:54,309 --> 00:44:51,200
real like

956
00:44:55,670 --> 00:44:54,319
stopping point in the whole uh flow

957
00:44:57,430 --> 00:44:55,680
uh sometimes things i probably should

958
00:44:59,430 --> 00:44:57,440
change that uh but usually if i find a

959
00:45:02,710 --> 00:44:59,440
good starting point in the episode

960
00:45:04,309 --> 00:45:02,720
it's time for another episode so right

961
00:45:06,230 --> 00:45:04,319
right uh so we can make it harder and

962
00:45:07,670 --> 00:45:06,240
sort things into them and i think also i

963
00:45:08,470 --> 00:45:07,680

try to play the scripts too much once

964

00:45:09,990 --> 00:45:08,480

they get to

965

00:45:11,430 --> 00:45:10,000

the right zone you know they've been

966

00:45:13,589 --> 00:45:11,440

edited on for a few days by the

967

00:45:14,870 --> 00:45:13,599

volunteers that's when it's recorded

968

00:45:16,390 --> 00:45:14,880

and they come back in a couple months

969

00:45:16,950 --> 00:45:16,400

later to put the video overlay on you

970

00:45:18,150 --> 00:45:16,960

know

971

00:45:19,990 --> 00:45:18,160

well i want to start off the

972

00:45:24,230 --> 00:45:20,000

conversation tonight uh

973

00:45:27,670 --> 00:45:24,240

with probably um

974

00:45:28,390 --> 00:45:27,680

the biggest and most controversial

975

00:45:31,990 --> 00:45:28,400

subject

976
00:45:34,870 --> 00:45:32,000
in all of uh theoretical mechanical

977
00:45:35,910 --> 00:45:34,880
any version of quantum physics or

978
00:45:39,589 --> 00:45:35,920
quantum mechanics

979
00:45:43,270 --> 00:45:39,599
quantum theory um which is

980
00:45:46,870 --> 00:45:43,280
measurement measurement and observation

981
00:45:48,950 --> 00:45:46,880
and it's a crazy subject

982
00:45:51,910 --> 00:45:48,960
because it's the biggest it's the

983
00:45:55,030 --> 00:45:51,920
broadest it's the foundation

984
00:45:58,710 --> 00:45:55,040
without a definition or agreement

985
00:46:00,069 --> 00:45:58,720
which is a very crazy thing to base a

986
00:46:02,150 --> 00:46:00,079
life on

987
00:46:03,510 --> 00:46:02,160
when you can't get two physicists to

988
00:46:06,870 --> 00:46:03,520

talk the same about it

989

00:46:07,430 --> 00:46:06,880

but there's that and so before we get

990

00:46:09,589 --> 00:46:07,440

started

991

00:46:10,870 --> 00:46:09,599

i had wrote earlier this week i want to

992

00:46:14,230 --> 00:46:10,880

run this by you

993

00:46:17,510 --> 00:46:14,240

i said so you're you're in physics 101

994

00:46:20,309 --> 00:46:17,520

freshman year college right

995

00:46:21,750 --> 00:46:20,319

and you're all excited first day and you

996

00:46:23,990 --> 00:46:21,760

raise your hand

997

00:46:25,670 --> 00:46:24,000

to to your professor standing in front

998

00:46:28,550 --> 00:46:25,680

of you and you go

999

00:46:30,470 --> 00:46:28,560

and he picks you and you go what is

1000

00:46:32,550 --> 00:46:30,480

measurement

1001

00:46:35,670 --> 00:46:32,560

and the professor is going to say

1002

00:46:39,990 --> 00:46:38,630

it's the foundation of everything but

1003

00:46:41,670 --> 00:46:40,000

it's not in your textbook

1004

00:46:43,030 --> 00:46:41,680

and i don't know what it is next

1005

00:46:44,390 --> 00:46:43,040

question please

1006

00:46:47,109 --> 00:46:44,400

right and then you're going to raise

1007

00:46:49,109 --> 00:46:47,119

your hand again and say

1008

00:46:50,309 --> 00:46:49,119

but what about bohr what about

1009

00:46:52,470 --> 00:46:50,319

heisenberg what about

1010

00:46:53,349 --> 00:46:52,480

uh you know what went on in copenhagen

1011

00:46:55,910 --> 00:46:53,359

what went on

1012

00:46:56,550 --> 00:46:55,920

and then later they and that and quantum

1013

00:46:58,710 --> 00:46:56,560

and then

1014

00:47:00,470 --> 00:46:58,720

a measurement was brought and and the

1015

00:47:01,349 --> 00:47:00,480

professor's going to cut you off again

1016

00:47:04,710 --> 00:47:01,359

and say

1017

00:47:06,550 --> 00:47:04,720

none of them agreed they only agreed on

1018

00:47:10,069 --> 00:47:06,560

the word

1019

00:47:13,190 --> 00:47:10,079

right now saying something like

1020

00:47:16,550 --> 00:47:13,200

that sounds like it's comedic

1021

00:47:20,230 --> 00:47:16,560

like i'm making it up and that it's just

1022

00:47:22,829 --> 00:47:20,240

funny ha ha how far off the mark

1023

00:47:24,790 --> 00:47:22,839

am i from your first day in physics

1024

00:47:26,230 --> 00:47:24,800

class um

1025

00:47:27,430 --> 00:47:26,240

i think we were mostly talking astronomy

1026
00:47:28,950 --> 00:47:27,440
that day and my professor asked me to

1027
00:47:30,950 --> 00:47:28,960
stop asking questions and wait till we

1028
00:47:32,470 --> 00:47:30,960
got that topic but uh measurement was

1029
00:47:34,549 --> 00:47:32,480
one ones i asked about

1030
00:47:36,069 --> 00:47:34,559
there is there has been since before we

1031
00:47:38,230 --> 00:47:36,079
even really had physics that big

1032
00:47:39,109 --> 00:47:38,240
question going back to people like bacon

1033
00:47:40,710 --> 00:47:39,119
is uh

1034
00:47:42,309 --> 00:47:40,720
when we look at something what are we

1035
00:47:43,349 --> 00:47:42,319
really seeing and how much that match up

1036
00:47:45,109 --> 00:47:43,359
to reality

1037
00:47:46,630 --> 00:47:45,119
and how do you actually measure it and

1038
00:47:49,190 --> 00:47:46,640

what does measurement mean

1039

00:47:50,309 --> 00:47:49,200

um you know it's a thing to forget for

1040

00:47:52,230 --> 00:47:50,319

instance we didn't actually have

1041

00:47:54,309 --> 00:47:52,240

thermometers or concept of thermometers

1042

00:47:57,430 --> 00:47:54,319

until like about two centuries ago

1043

00:47:58,870 --> 00:47:57,440

um and uh a lot of these basic

1044

00:48:00,630 --> 00:47:58,880

measurement concepts

1045

00:48:01,750 --> 00:48:00,640

were already starting to hurt problems

1046

00:48:03,030 --> 00:48:01,760

we're always starting to break down

1047

00:48:05,750 --> 00:48:03,040

philosophically

1048

00:48:07,190 --> 00:48:05,760

before we even have the concept of

1049

00:48:09,030 --> 00:48:07,200

quantum coming in there

1050

00:48:11,030 --> 00:48:09,040

and i think people miss is quantum is

1051

00:48:12,470 --> 00:48:11,040

such a word we all know these days

1052

00:48:14,309 --> 00:48:12,480

that we identified the root word of

1053

00:48:17,030 --> 00:48:14,319

quantum is quantifiable

1054

00:48:18,710 --> 00:48:17,040

in individual bit this idea that down a

1055

00:48:20,630 --> 00:48:18,720

certain level the universe is

1056

00:48:21,829 --> 00:48:20,640

split into individual bits that we can

1057

00:48:22,630 --> 00:48:21,839

absorb and they're fuzzy and they're

1058

00:48:24,390 --> 00:48:22,640

hazy

1059

00:48:26,390 --> 00:48:24,400

and that is quantum cast the study of

1060

00:48:27,589 --> 00:48:26,400

the very tiny quantum things that don't

1061

00:48:29,190 --> 00:48:27,599

have a you know

1062

00:48:31,190 --> 00:48:29,200

a broad spectrum of resistance but these

1063

00:48:33,030 --> 00:48:31,200

discrete finite things like a

1064

00:48:34,549 --> 00:48:33,040

an electron a proton a neutron that

1065

00:48:37,190 --> 00:48:34,559

they're not or the quarks they're made

1066

00:48:39,109 --> 00:48:37,200

up of that they're not um

1067

00:48:40,309 --> 00:48:39,119

you know not divisible in a different

1068

00:48:41,750 --> 00:48:40,319

part you have to break them into very

1069

00:48:43,349 --> 00:48:41,760

tiny specific things

1070

00:48:45,750 --> 00:48:43,359

they have certain energy levels they can

1071

00:48:47,829 --> 00:48:45,760

be at as opposed to anywhere in between

1072

00:48:49,109 --> 00:48:47,839

and this is where we started wondering

1073

00:48:51,030 --> 00:48:49,119

is you know

1074

00:48:52,950 --> 00:48:51,040

how connected all things like space and

1075

00:48:54,230 --> 00:48:52,960

time yeah as we got with with einstein

1076

00:48:56,230 --> 00:48:54,240

for instance these things

1077

00:48:57,750 --> 00:48:56,240

which before always seem separate it's

1078

00:48:59,030 --> 00:48:57,760

not just space and time which always

1079

00:49:00,790 --> 00:48:59,040

hear about us being connected

1080

00:49:02,790 --> 00:49:00,800

energy and time are connected momentum

1081

00:49:05,910 --> 00:49:02,800

and and velocity and position are

1082

00:49:07,589 --> 00:49:05,920

collected almost every property in in

1083

00:49:09,990 --> 00:49:07,599

physics in in the universe

1084

00:49:11,430 --> 00:49:10,000

has some complementary property that

1085

00:49:14,470 --> 00:49:11,440

it's very connected with

1086

00:49:15,829 --> 00:49:14,480

at a level of uncertainty and these are

1087

00:49:17,349 --> 00:49:15,839

the things helping the questions of not

1088

00:49:18,950 --> 00:49:17,359

just the philosophical how do we measure

1089

00:49:20,950 --> 00:49:18,960

something but

1090

00:49:22,309 --> 00:49:20,960

how accurate can we ever be with the

1091

00:49:24,790 --> 00:49:22,319

measurement uh

1092

00:49:26,390 --> 00:49:24,800

as an example we're busy calculating the

1093

00:49:27,349 --> 00:49:26,400

nth digit of pi i think looks like a

1094

00:49:29,270 --> 00:49:27,359

trillion

1095

00:49:30,870 --> 00:49:29,280

but inside the known universe you really

1096

00:49:31,589 --> 00:49:30,880

never need more than 40 digits by

1097

00:49:33,190 --> 00:49:31,599

because

1098

00:49:34,390 --> 00:49:33,200

the universe just doesn't scale beyond

1099

00:49:36,230 --> 00:49:34,400

that you would never have occasionally

1100

00:49:37,990 --> 00:49:36,240

need to be more accurate than 40

1101
00:49:39,430 --> 00:49:38,000
even if you're trying to measure one

1102
00:49:40,790 --> 00:49:39,440
atom's width or across the entire

1103
00:49:43,109 --> 00:49:40,800
universe's circle

1104
00:49:45,109 --> 00:49:43,119
you know so quickly off by that amount

1105
00:49:46,710 --> 00:49:45,119
so it's it's very

1106
00:49:47,990 --> 00:49:46,720
strange and fuzzy you can see it washing

1107
00:49:49,270 --> 00:49:48,000
down to the plank level where things

1108
00:49:49,990 --> 00:49:49,280
start to be the point where you don't

1109
00:49:51,589 --> 00:49:50,000
think they can even

1110
00:49:53,190 --> 00:49:51,599
exist beneath that scale it's a

1111
00:49:55,349 --> 00:49:53,200
meaningful concept and that's way better

1112
00:49:57,990 --> 00:49:55,359
the atomic scale an atom's like a galaxy

1113
00:50:01,910 --> 00:49:58,000

compared to the planck scale

1114

00:50:05,510 --> 00:50:01,920

and now when we talk in in these

1115

00:50:07,829 --> 00:50:05,520

terms if we discuss

1116

00:50:10,829 --> 00:50:07,839

measurement don't we have to have an

1117

00:50:12,549 --> 00:50:10,839

understanding or a definition of what it

1118

00:50:15,510 --> 00:50:12,559

is

1119

00:50:17,510 --> 00:50:15,520

and well okay now see that's that's the

1120

00:50:21,589 --> 00:50:17,520

answer

1121

00:50:23,109 --> 00:50:21,599

tautologies but you are actually allowed

1122

00:50:23,829 --> 00:50:23,119

to have tautologies of circular

1123

00:50:25,910 --> 00:50:23,839

reasoning

1124

00:50:27,990 --> 00:50:25,920

in the science and physics it's not

1125

00:50:29,990 --> 00:50:28,000

ideal but you are allowed to have them

1126

00:50:31,430 --> 00:50:30,000

you know what is space and if you look

1127

00:50:32,069 --> 00:50:31,440

up the definition of something that says

1128

00:50:37,430 --> 00:50:32,079

uh

1129

00:50:38,710 --> 00:50:37,440

look something up and

1130

00:50:40,549 --> 00:50:38,720

references the other thing and it says

1131

00:50:42,390 --> 00:50:40,559

go look the other one back up that's

1132

00:50:43,910 --> 00:50:42,400

allowed inside the sciences these are

1133

00:50:45,750 --> 00:50:43,920

discrete concepts that can only be

1134

00:50:47,030 --> 00:50:45,760

explained in terms of each other it's

1135

00:50:48,549 --> 00:50:47,040

kind of neat that they turn out to have

1136

00:50:49,510 --> 00:50:48,559

complementary things like energy and

1137

00:50:52,309 --> 00:50:49,520

time too

1138

00:50:54,069 --> 00:50:52,319

but um we don't really have a clear

1139

00:50:56,549 --> 00:50:54,079

definition of measurement beyond

1140

00:50:58,230 --> 00:50:56,559

here's how i take something and quantify

1141

00:51:00,870 --> 00:50:58,240

something else in terms of it

1142

00:51:02,150 --> 00:51:00,880

um you know the three laws of thorium

1143

00:51:03,829 --> 00:51:02,160

was very famous and we had to make

1144

00:51:05,829 --> 00:51:03,839

another one a zeroth law

1145

00:51:07,430 --> 00:51:05,839

that simply just says thermometers walk

1146

00:51:11,109 --> 00:51:07,440

that is the zeroth law of

1147

00:51:14,230 --> 00:51:11,119

right right okay

1148

00:51:20,390 --> 00:51:14,240

so what is your definition

1149

00:51:23,510 --> 00:51:21,750

i don't know that i could give a very

1150

00:51:26,950 --> 00:51:23,520

good one uh yeah that's that's

1151
00:51:30,790 --> 00:51:26,960
that's my answer isn't that how can that

1152
00:51:33,910 --> 00:51:30,800
be when we know that measurement

1153
00:51:35,270 --> 00:51:33,920
and observation is first off the

1154
00:51:37,430 --> 00:51:35,280
foundation

1155
00:51:39,510 --> 00:51:37,440
of everything in quantum physics quantum

1156
00:51:42,790 --> 00:51:39,520
mechanics you just said it yourself

1157
00:51:45,109 --> 00:51:42,800
uh velocity right we

1158
00:51:47,349 --> 00:51:45,119
you know you have these uh two three

1159
00:51:50,150 --> 00:51:47,359
four points in physics that

1160
00:51:50,870 --> 00:51:50,160
are at least three of these have to be

1161
00:51:54,390 --> 00:51:50,880
involved in

1162
00:51:57,270 --> 00:51:54,400
any equation to get the number started

1163
00:51:59,109 --> 00:51:57,280

right to get a symbol on on the white

1164

00:52:00,309 --> 00:51:59,119

board you're starting with one of these

1165

00:52:02,069 --> 00:52:00,319

things

1166

00:52:03,750 --> 00:52:02,079

right well you have to accept the very

1167

00:52:04,710 --> 00:52:03,760

concept of numbers being valid before

1168

00:52:05,990 --> 00:52:04,720

you can even start with measurement

1169

00:52:07,190 --> 00:52:06,000

because essentially it's it's how do i

1170

00:52:09,510 --> 00:52:07,200

numerically quantify

1171

00:52:11,030 --> 00:52:09,520

some property and measuring length is

1172

00:52:12,470 --> 00:52:11,040

not the same as measuring temperature or

1173

00:52:14,630 --> 00:52:12,480

measuring time

1174

00:52:16,230 --> 00:52:14,640

and if time is variable to how fast

1175

00:52:17,190 --> 00:52:16,240

you're going through space then

1176

00:52:19,349 --> 00:52:17,200

how do you measure that without

1177

00:52:20,870 --> 00:52:19,359

measuring most of the time and it gets a

1178

00:52:21,349 --> 00:52:20,880

little bit of a philosophical headache

1179

00:52:22,950 --> 00:52:21,359

but

1180

00:52:24,549 --> 00:52:22,960

that's not the only one you tend to get

1181

00:52:25,990 --> 00:52:24,559

in times of these things either you know

1182

00:52:27,589 --> 00:52:26,000

quantum is just

1183

00:52:29,190 --> 00:52:27,599

a quantum is an existential crisis

1184

00:52:30,390 --> 00:52:29,200

waiting to happen so it's relativity

1185

00:52:32,549 --> 00:52:30,400

it's it's hard to really go through

1186

00:52:34,390 --> 00:52:32,559

those things because it isn't intuitive

1187

00:52:35,829 --> 00:52:34,400

it's not wrong though but it's it

1188

00:52:37,430 --> 00:52:35,839

challenges our intuition

1189

00:52:39,750 --> 00:52:37,440

you know what we see at the macroscopic

1190

00:52:41,349 --> 00:52:39,760

level kind of absorbing that that is not

1191

00:52:43,990 --> 00:52:41,359

really how the universe works

1192

00:52:44,790 --> 00:52:44,000

that is just how our local rules work

1193

00:52:47,670 --> 00:52:44,800

now

1194

00:52:48,710 --> 00:52:47,680

is it like the thermometer where

1195

00:52:53,030 --> 00:52:48,720

measurement

1196

00:52:54,390 --> 00:52:53,040

just is in the case of thermometer you

1197

00:52:56,390 --> 00:52:54,400

know you let's say you were taking the

1198

00:52:58,230 --> 00:52:56,400

classic one the little mercury tube

1199

00:53:00,150 --> 00:52:58,240

we say we're going to mark off grades on

1200

00:53:03,349 --> 00:53:00,160

this we know it expands x amount

1201
00:53:06,150 --> 00:53:03,359
and we've been set to zero was in in in

1202
00:53:07,349 --> 00:53:06,160
cold water icy water and 100 uh when it

1203
00:53:08,950 --> 00:53:07,359
was in boiling model

1204
00:53:10,470 --> 00:53:08,960
and we just mark 100 spots along there

1205
00:53:11,990 --> 00:53:10,480
they're evenly placed those are the

1206
00:53:14,069 --> 00:53:12,000
degrees

1207
00:53:15,270 --> 00:53:14,079
but mercury doesn't expand at exactly

1208
00:53:16,790 --> 00:53:15,280
the same rate

1209
00:53:19,030 --> 00:53:16,800
for each of those amounts of energy or

1210
00:53:20,630 --> 00:53:19,040
degrees in it so it wasn't actually

1211
00:53:23,109 --> 00:53:20,640
going up one

1212
00:53:24,950 --> 00:53:23,119
this is why i got three there was

1213
00:53:27,030 --> 00:53:24,960

literally pages and pages about i should

1214

00:53:28,710 --> 00:53:27,040

say pages pages libraries and libraries

1215

00:53:30,710 --> 00:53:28,720

of various ways in which we've

1216

00:53:33,190 --> 00:53:30,720

classified measurement down the years

1217

00:53:34,870 --> 00:53:33,200

uh the entire bureau is based on it and

1218

00:53:36,390 --> 00:53:34,880

things you wouldn't even expect you know

1219

00:53:38,309 --> 00:53:36,400

you've got this big ball that's supposed

1220

00:53:39,510 --> 00:53:38,319

to measure distance but it's

1221

00:53:40,710 --> 00:53:39,520

a different temperature at the place

1222

00:53:42,390 --> 00:53:40,720

you're at or it's different pressure so

1223

00:53:43,990 --> 00:53:42,400

the bar was not as long

1224

00:53:46,950 --> 00:53:44,000

and he'd say well now the ball is wrong

1225

00:53:48,630 --> 00:53:46,960

he said well is the ball wrong or

1226
00:53:49,670 --> 00:53:48,640
are we maybe looking at the idea of

1227
00:53:51,190 --> 00:53:49,680
measurement of this case a little bit

1228
00:53:52,950 --> 00:53:51,200
long in the first place

1229
00:53:55,270 --> 00:53:52,960
and in some cases that's maybe a little

1230
00:53:58,630 --> 00:53:55,280
bit more philosophically valid

1231
00:54:02,069 --> 00:53:58,640
um and then we have uh

1232
00:54:02,790 --> 00:54:02,079
for me and this is where i think most

1233
00:54:06,230 --> 00:54:02,800
people that

1234
00:54:09,190 --> 00:54:06,240
start to get into physics and listen to

1235
00:54:11,030 --> 00:54:09,200
discussions about it it's it's at one of

1236
00:54:13,030 --> 00:54:11,040
those points where you're trying to wrap

1237
00:54:15,190 --> 00:54:13,040
your mind around what measurement is

1238
00:54:16,230 --> 00:54:15,200

because measurement is always part of

1239

00:54:19,670 --> 00:54:16,240

the conversation

1240

00:54:21,109 --> 00:54:19,680

right and you're trying to absorb it

1241

00:54:24,630 --> 00:54:21,119

you're getting into it

1242

00:54:28,470 --> 00:54:24,640

and then observation comes into play

1243

00:54:29,829 --> 00:54:28,480

and the use of observation which we'll

1244

00:54:32,950 --> 00:54:29,839

get to after the break

1245

00:54:36,470 --> 00:54:32,960

which where it goes into total nutsville

1246

00:54:40,470 --> 00:54:36,480

but observation is uh

1247

00:54:43,990 --> 00:54:40,480

used instead of the word measurement

1248

00:54:45,190 --> 00:54:44,000

in a lot of physics where observation

1249

00:54:47,270 --> 00:54:45,200

and measurement

1250

00:54:48,789 --> 00:54:47,280

are the same thing and you would say to

1251

00:54:52,150 --> 00:54:48,799

yourself how can that

1252

00:54:57,270 --> 00:54:52,160

be so now let's move to observation

1253

00:55:00,069 --> 00:54:58,230

trying to think one that's not going to

1254

00:55:02,069 --> 00:55:00,079

be a tautology a measurement being

1255

00:55:04,829 --> 00:55:02,079

essentially the numerical quantification

1256

00:55:06,069 --> 00:55:04,839

of observations we might then say that

1257

00:55:09,910 --> 00:55:06,079

observation

1258

00:55:13,190 --> 00:55:09,920

is you know i i have no idea

1259

00:55:16,230 --> 00:55:13,200

uh how would you i love you man and see

1260

00:55:18,150 --> 00:55:16,240

and and and this is this is one of the

1261

00:55:20,710 --> 00:55:18,160

things and the challenges for me

1262

00:55:21,750 --> 00:55:20,720

uh that i appreciate so much in physics

1263

00:55:23,750 --> 00:55:21,760

is that

1264

00:55:25,910 --> 00:55:23,760

uh you can't get a straight answer

1265

00:55:28,309 --> 00:55:25,920

nobody knows which is fine

1266

00:55:29,109 --> 00:55:28,319

but it's this sense of wonder with all

1267

00:55:32,230 --> 00:55:29,119

of this

1268

00:55:32,870 --> 00:55:32,240

for me i just find it so fascinating i

1269

00:55:35,750 --> 00:55:32,880

don't care

1270

00:55:37,030 --> 00:55:35,760

what level you get in the physics world

1271

00:55:39,430 --> 00:55:37,040

these are the answers

1272

00:55:40,150 --> 00:55:39,440

that we are going to get it's not in a

1273

00:55:42,950 --> 00:55:40,160

textbook

1274

00:55:44,069 --> 00:55:42,960

is it no well i mean there are probably

1275

00:55:45,670 --> 00:55:44,079

lots of folks who have written on this

1276

00:55:47,589 --> 00:55:45,680

topic so who are probably a lot smarter

1277

00:55:49,670 --> 00:55:47,599

than i am and explained it but

1278

00:55:51,829 --> 00:55:49,680

observation is a tricky one how do you i

1279

00:55:52,950 --> 00:55:51,839

mean those forces can you ever trust

1280

00:55:54,150 --> 00:55:52,960

your observations

1281

00:55:56,309 --> 00:55:54,160

you have to work from the assumption

1282

00:55:57,990 --> 00:55:56,319

that yes you can uh not because that's

1283

00:55:59,430 --> 00:55:58,000

necessarily true but because

1284

00:56:00,870 --> 00:55:59,440

if you can't even start on that spot

1285

00:56:02,230 --> 00:56:00,880

you're not going to make much progress

1286

00:56:03,990 --> 00:56:02,240

you have to work on the assumption that

1287

00:56:05,750 --> 00:56:04,000

what you're observing about the universe

1288

00:56:07,829 --> 00:56:05,760

is

1289

00:56:09,430 --> 00:56:07,839

mostly accurate but of course we know it

1290

00:56:11,109 --> 00:56:09,440

isn't you know and again that i think i

1291

00:56:12,470 --> 00:56:11,119

mentioned francis bacon earlier here the

1292

00:56:13,910 --> 00:56:12,480

big point is you reach down and touch

1293

00:56:15,589 --> 00:56:13,920

some polished table

1294

00:56:17,349 --> 00:56:15,599

it feels so smooth but if you look at a

1295

00:56:18,630 --> 00:56:17,359

microscope these brand new microscopes

1296

00:56:20,470 --> 00:56:18,640

they had news around

1297

00:56:22,390 --> 00:56:20,480

you could see these vast mountains and

1298

00:56:23,829 --> 00:56:22,400

valleys of material down there it wasn't

1299

00:56:25,430 --> 00:56:23,839

smooth at all

1300

00:56:26,630 --> 00:56:25,440

uh you know we see the light bounced off

1301

00:56:27,990 --> 00:56:26,640

at certain angles but it tells you what

1302

00:56:29,589 --> 00:56:28,000

the color is and we find out

1303

00:56:30,710 --> 00:56:29,599

that object isn't really green just

1304

00:56:32,390 --> 00:56:30,720

because it looks green that's the light

1305

00:56:34,150 --> 00:56:32,400

that it effects away it's these other

1306

00:56:36,150 --> 00:56:34,160

colors that it's absorbing

1307

00:56:37,349 --> 00:56:36,160

so it is always kind of hard to say with

1308

00:56:38,789 --> 00:56:37,359

observation

1309

00:56:41,109 --> 00:56:38,799

what you really mean by it how much you

1310

00:56:42,470 --> 00:56:41,119

can trust it and i guess science is

1311

00:56:43,829 --> 00:56:42,480

really about making observations and

1312

00:56:45,030 --> 00:56:43,839

trying to do them in a quantifiable way

1313

00:56:46,230 --> 00:56:45,040

that lets us start to check their

1314

00:56:47,510 --> 00:56:46,240

validity

1315

00:56:49,030 --> 00:56:47,520

but it does have to be against each

1316

00:56:50,309 --> 00:56:49,040

other there is a certain

1317

00:56:54,870 --> 00:56:50,319

self-referential

1318

00:56:56,150 --> 00:56:54,880

have to start with the assumptions valid

1319

00:56:59,030 --> 00:56:56,160

but you can't actually prove that inside

1320

00:57:02,549 --> 00:56:59,040

a scientific context of course

1321

00:57:04,390 --> 00:57:02,559

okay now i'm looking at the clock i've

1322

00:57:08,069 --> 00:57:04,400

got about two minutes

1323

00:57:12,230 --> 00:57:08,079

how is it possible to especially

1324

00:57:13,430 --> 00:57:12,240

going back to 1930 okay uh 1927

1325

00:57:17,589 --> 00:57:13,440

copenhagen

1326
00:57:20,789 --> 00:57:17,599
quantum and and and those uh parts of

1327
00:57:22,950 --> 00:57:20,799
uh physics are now introduced you know

1328
00:57:24,150 --> 00:57:22,960
it was a big conference and everybody

1329
00:57:26,630 --> 00:57:24,160
knows about that we don't

1330
00:57:29,349 --> 00:57:26,640
need to get into that but there wasn't

1331
00:57:32,870 --> 00:57:29,359
an ability at that time

1332
00:57:36,470 --> 00:57:32,880
to look at particles this small

1333
00:57:39,670 --> 00:57:36,480
didn't have it so how does measurement

1334
00:57:42,630 --> 00:57:39,680
and and observation

1335
00:57:44,150 --> 00:57:42,640
come into play with stuff that you can't

1336
00:57:45,670 --> 00:57:44,160
see

1337
00:57:46,789 --> 00:57:45,680
you know there's each of these particles

1338
00:57:47,990 --> 00:57:46,799

has an interesting story on how they're

1339

00:57:49,670 --> 00:57:48,000

made but i always think what my

1340

00:57:51,589 --> 00:57:49,680

professor was said to be on these things

1341

00:57:53,430 --> 00:57:51,599

physics at the atomic scale

1342

00:57:55,190 --> 00:57:53,440

is about kicking a dog and measuring its

1343

00:57:56,789 --> 00:57:55,200

properties by how loud it bulks

1344

00:57:59,829 --> 00:57:56,799

basically we ran things into each other

1345

00:58:01,589 --> 00:57:59,839

and see what we're getting as a scatter

1346

00:58:02,630 --> 00:58:01,599

it's crazy and that is yeah that's

1347

00:58:03,430 --> 00:58:02,640

pretty much how we looked at all these

1348

00:58:05,670 --> 00:58:03,440

things

1349

00:58:07,030 --> 00:58:05,680

um some of them we we found as uh you

1350

00:58:09,829 --> 00:58:07,040

know exposures on film

1351
00:58:11,750 --> 00:58:09,839
uh of an accent all those it was you

1352
00:58:12,789 --> 00:58:11,760
know radiation burns on things are those

1353
00:58:13,910 --> 00:58:12,799
it was

1354
00:58:15,750 --> 00:58:13,920
tiny little things like how much

1355
00:58:16,309 --> 00:58:15,760
electron was deflected when it ran

1356
00:58:18,789 --> 00:58:16,319
through

1357
00:58:19,910 --> 00:58:18,799
you know a plate of gold and we started

1358
00:58:21,990 --> 00:58:19,920
getting way better at that but our

1359
00:58:23,829 --> 00:58:22,000
fundamental approach is still

1360
00:58:25,030 --> 00:58:23,839
you know to you know ram things together

1361
00:58:27,510 --> 00:58:25,040
really fast

1362
00:58:29,190 --> 00:58:27,520
and then measure what slams into all

1363
00:58:30,390 --> 00:58:29,200

detectors on the side in terms of energy

1364

00:58:33,990 --> 00:58:30,400

values

1365

00:58:37,270 --> 00:58:34,000

when was the last time you wrote

1366

00:58:39,750 --> 00:58:37,280

an equation on a whiteboard on a

1367

00:58:41,300 --> 00:58:39,760

whiteboard

1368

00:58:43,670 --> 00:58:41,310

not in the last year

1369

00:58:47,430 --> 00:58:43,680

[Laughter]

1370

00:58:49,109 --> 00:58:47,440

are you still smooth with it um

1371

00:58:50,150 --> 00:58:49,119

i probably could still get away with it

1372

00:58:51,750 --> 00:58:50,160

i just don't have any white boards

1373

00:58:54,390 --> 00:58:51,760

around i tend to use

1374

00:58:56,549 --> 00:58:54,400

very old paper but i tend to have a

1375

00:58:59,670 --> 00:58:56,559

thing for handmade people these days

1376

00:59:01,589 --> 00:58:59,680

right right right that's funny um

1377

00:59:02,870 --> 00:59:01,599

but i've always been fascinated with

1378

00:59:09,750 --> 00:59:02,880

that

1379

00:59:12,870 --> 00:59:09,760

physicists

1380

00:59:16,069 --> 00:59:12,880

that their description of

1381

00:59:19,109 --> 00:59:16,079

their uh algorithms

1382

00:59:22,950 --> 00:59:19,119

their sequences their numbers their math

1383

00:59:26,230 --> 00:59:22,960

their symbols is is accurate

1384

00:59:29,430 --> 00:59:26,240

because they are translating their

1385

00:59:31,990 --> 00:59:29,440

numbers for us verbally

1386

00:59:33,349 --> 00:59:32,000

in many cases one things i loved about

1387

00:59:35,030 --> 00:59:33,359

physics it was one of the few places i

1388

00:59:36,950 --> 00:59:35,040

could have a classroom and the professor

1389

00:59:38,950 --> 00:59:36,960

would uh if you you know if you asked

1390

00:59:39,990 --> 00:59:38,960

him why you know if why you didn't

1391

00:59:41,349 --> 00:59:40,000

understand something if you didn't

1392

00:59:42,630 --> 00:59:41,359

correct them if you didn't catch the

1393

00:59:44,150 --> 00:59:42,640

arrow he did it on the board

1394

00:59:45,589 --> 00:59:44,160

he'd yell at you for not correcting

1395

00:59:46,069 --> 00:59:45,599

where as almost every class i was at

1396

00:59:47,670 --> 00:59:46,079

they'd

1397

00:59:49,510 --> 00:59:47,680

get angry that you you know they would

1398

00:59:51,270 --> 00:59:49,520

even ask that they might be bombed

1399

00:59:52,870 --> 00:59:51,280

and you have to take a lot of non-faith

1400

00:59:55,270 --> 00:59:52,880

she can never replicate at all

1401

00:59:56,710 --> 00:59:55,280

but you have to be willing to actually

1402

00:59:58,069 --> 00:59:56,720

attack every premise

1403

00:59:59,670 --> 00:59:58,079

in order to really make progress in

1404

01:00:00,950 --> 00:59:59,680

something as basic as physics or

1405

01:00:02,710 --> 01:00:00,960

metaphysics these are

1406

01:00:04,230 --> 01:00:02,720

these core philosophies of thought and

1407

01:00:06,069 --> 01:00:04,240

how the universe is structured and the

1408

01:00:07,670 --> 01:00:06,079

only way you ever make progress

1409

01:00:10,390 --> 01:00:07,680

is to constantly work on the assumption

1410

01:00:13,670 --> 01:00:10,400

that there's a big arrow going on

1411

01:00:14,069 --> 01:00:13,680

um and you know you have any feel or a

1412

01:00:15,589 --> 01:00:14,079

certain

1413

01:00:16,549 --> 01:00:15,599

feel of people feeling like they have to

1414

01:00:18,390 --> 01:00:16,559

protect their own domain and their

1415

01:00:19,589 --> 01:00:18,400

reputation not be open new ideas but i'd

1416

01:00:20,309 --> 01:00:19,599

say that for the most part physics

1417

01:00:22,069 --> 01:00:20,319

remain

1418

01:00:23,589 --> 01:00:22,079

relatively uncontaminated by it's not as

1419

01:00:26,309 --> 01:00:23,599

bad as a lot of the fears can get

1420

01:00:27,430 --> 01:00:26,319

well physicists today are the modern

1421

01:00:30,630 --> 01:00:27,440

version

1422

01:00:32,950 --> 01:00:30,640

of the priests from the mystery schools

1423

01:00:35,589 --> 01:00:32,960

five thousand years ago

1424

01:00:37,670 --> 01:00:35,599

right we're taking we're taking their

1425

01:00:39,510 --> 01:00:37,680

math on faith

1426

01:00:41,030 --> 01:00:39,520

i don't i can't read it i can't

1427

01:00:42,710 --> 01:00:41,040

translate it

1428

01:00:44,390 --> 01:00:42,720

i mean you you can walk back through the

1429

01:00:45,670 --> 01:00:44,400

basic premises in a lot of cases but you

1430

01:00:48,150 --> 01:00:45,680

won't have done them all you know you've

1431

01:00:49,910 --> 01:00:48,160

got a big row of textbooks on topic

1432

01:00:51,349 --> 01:00:49,920

you learn something you you look into

1433

01:00:52,710 --> 01:00:51,359

something but you take some amount of

1434

01:00:54,549 --> 01:00:52,720

faith and trust yeah

1435

01:00:55,589 --> 01:00:54,559

um you know when was last time ever

1436

01:00:56,870 --> 01:00:55,599

actually wouldn't check to see that the

1437

01:00:58,230 --> 01:00:56,880

actual circumference of i don't think

1438

01:00:59,589 --> 01:00:58,240

i've ever measured the circumference of

1439

01:01:01,430 --> 01:00:59,599

a circle possibly and see if it really

1440

01:01:03,750 --> 01:01:01,440

was pie

1441

01:01:05,430 --> 01:01:03,760

let's take our break right here our

1442

01:01:08,390 --> 01:01:05,440

guest tonight the one and only isaac

1443

01:01:09,109 --> 01:01:08,400

arthur future science with isaac arthur

1444

01:01:11,710 --> 01:01:09,119

the links

1445

01:01:13,030 --> 01:01:11,720

uh for isaacarthur.net or right there

1446

01:01:14,470 --> 01:01:13,040

jimmychurchradio.com

1447

01:01:16,230 --> 01:01:14,480

we'll be right back after this show

1448

01:01:17,829 --> 01:01:16,240

break more with isaac when we come back

1449

01:01:18,549 --> 01:01:17,839

this is faded black and the game changer

1450

01:01:25,340 --> 01:01:18,559

network

1451

01:01:47,030 --> 01:01:25,350

and kgra the planet stay with us

1452

01:01:49,190 --> 01:01:47,040

[Music]

1453

01:01:51,589 --> 01:01:49,200

this is fade to black with jimmy church

1454

01:01:56,549 --> 01:01:51,599

on the game changer radio network

1455

01:01:59,029 --> 01:01:56,559

and kgra the global radio alliance

1456

01:02:00,069 --> 01:01:59,039

this is kgra digital broadcasting

1457

01:02:04,470 --> 01:02:00,079

station

1458

01:02:06,470 --> 01:02:04,480

salt lake city utah van buren arkansas

1459

01:02:08,150 --> 01:02:06,480

hello my name is billy carson and i'm a

1460

01:02:10,390 --> 01:02:08,160

best-selling author and the founder of

1461

01:02:12,309 --> 01:02:10,400

forbidden knowledge dot tv together with

1462

01:02:13,750 --> 01:02:12,319

my team we have built a all new content

1463

01:02:15,349 --> 01:02:13,760

streaming tv platform

1464

01:02:17,270 --> 01:02:15,359

designed with every family member in

1465

01:02:18,549 --> 01:02:17,280

mind if you have ever wanted to travel

1466

01:02:20,069 --> 01:02:18,559

the world and attend lectures and

1467

01:02:21,190 --> 01:02:20,079

workshops from your favorite speakers

1468

01:02:23,829 --> 01:02:21,200

but weren't able to

1469

01:02:24,470 --> 01:02:23,839

look no further forbidden knowledge dot

1470

01:02:26,150 --> 01:02:24,480

tv

1471

01:02:28,069 --> 01:02:26,160

there are dozens of workshops and

1472

01:02:30,150 --> 01:02:28,079

lectures from speakers you know and love

1473

01:02:32,069 --> 01:02:30,160

we have also included amazing categories

1474

01:02:33,829 --> 01:02:32,079

to assure that your consciousness is

1475

01:02:34,549 --> 01:02:33,839

entertained and elevating on a daily

1476

01:02:36,630 --> 01:02:34,559

basis

1477

01:02:37,829 --> 01:02:36,640

amazing interviews ancient history

1478

01:02:39,829 --> 01:02:37,839

ascension knowledge

1479

01:02:40,950 --> 01:02:39,839

wisdom teachings documentaries

1480

01:02:43,190 --> 01:02:40,960

conspiracies

1481

01:02:45,910 --> 01:02:43,200

mysteries health and fitness conscious

1482

01:02:47,990 --> 01:02:45,920

cooking meditations finance yoga and so

1483

01:02:50,150 --> 01:02:48,000

much more to start your free trial on

1484

01:02:52,309 --> 01:02:50,160

any mobile device or computer surf to

1485

01:02:54,069 --> 01:02:52,319

forbidden knowledge dot tv

1486

01:02:57,190 --> 01:02:54,079

that's forbidden knowledge with the

1487

01:03:00,829 --> 01:02:57,200

number four forbidden knowledge dot tv

1488

01:03:02,470 --> 01:03:00,839

again visit forbidden knowledge dot tv

1489

01:03:05,670 --> 01:03:02,480

today

1490

01:03:08,069 --> 01:03:05,680

listen i know and you know that you've

1491

01:03:10,309 --> 01:03:08,079

always wanted your first crystal skull

1492

01:03:12,470 --> 01:03:10,319

or maybe you're a collector just like me

1493

01:03:14,230 --> 01:03:12,480

but you just don't know where to go to

1494

01:03:17,549 --> 01:03:14,240

find the real thing

1495

01:03:18,950 --> 01:03:17,559

then i met carolyn ford over at

1496

01:03:21,349 --> 01:03:18,960

einsteinthecrystalskull.com

1497

01:03:23,349 --> 01:03:21,359

carolyn is the guardian of einstein one

1498

01:03:24,870 --> 01:03:23,359

of the most respected ancient crystal

1499

01:03:26,549 --> 01:03:24,880

skulls in the world

1500

01:03:28,789 --> 01:03:26,559

all of her unique skulls have been

1501

01:03:29,990 --> 01:03:28,799

imprinted sitting with einstein in his

1502

01:03:31,990 --> 01:03:30,000

sacred lodge and are

1503

01:03:33,029 --> 01:03:32,000

carved from the finest gemstone and

1504

01:03:35,190 --> 01:03:33,039

materials

1505

01:03:37,750 --> 01:03:35,200

imprinting is the process of receiving

1506

01:03:39,270 --> 01:03:37,760

the ancient wisdom from the master skull

1507

01:03:42,309 --> 01:03:39,280

or master computer

1508

01:03:44,069 --> 01:03:42,319

einstein the ancient crystal skull

1509

01:03:46,470 --> 01:03:44,079

to see carolyn's current collection of

1510

01:03:49,109 --> 01:03:46,480

crystal skulls just visit her store at

1511

01:03:51,430 --> 01:03:49,119

einstein the crystal skull dot com or

1512

01:03:53,829 --> 01:03:51,440

click on the banner over on our site

1513

01:03:55,829 --> 01:03:53,839

don't forget to use the promo code jimmy

1514

01:03:58,309 --> 01:03:55,839

at checkout to receive 10

1515

01:03:59,109 --> 01:03:58,319

off of your order today that's promo

1516

01:04:01,670 --> 01:03:59,119

code

1517

01:04:02,950 --> 01:04:01,680

jimmy finding your first or next crystal

1518

01:04:08,470 --> 01:04:02,960

skull is easy

1519

01:04:13,190 --> 01:04:10,549

when you take the beans from central

1520

01:04:14,470 --> 01:04:13,200

america with dashes of indonesian and

1521

01:04:16,710 --> 01:04:14,480

african mixed in

1522

01:04:18,069 --> 01:04:16,720

and then roasted to the dark side of

1523

01:04:21,349 --> 01:04:18,079

fade to black

1524

01:04:24,309 --> 01:04:21,359

you create the ultimate brew of fringe

1525

01:04:25,029 --> 01:04:24,319

introducing the fade to black blend from

1526

01:04:30,549 --> 01:04:25,039

river moon

1527

01:04:31,029 --> 01:04:30,559

customized roast was created for the

1528

01:04:34,230 --> 01:04:31,039

love

1529

01:04:37,029 --> 01:04:34,240

of fade to black the alchemy of

1530

01:04:38,230 --> 01:04:37,039

masterful roasting and smoking the beans

1531

01:04:41,910 --> 01:04:38,240

is in every sip

1532

01:04:43,349 --> 01:04:41,920

of this full-bodied dark java i need my

1533

01:04:45,910 --> 01:04:43,359

coffee doc

1534

01:04:46,870 --> 01:04:45,920

deep with distinct bittersweet chocolate

1535

01:04:49,430 --> 01:04:46,880

highlights

1536

01:04:51,430 --> 01:04:49,440

just like the bunker leaning further

1537

01:04:54,069 --> 01:04:51,440

into the darkness of the roast

1538

01:04:54,950 --> 01:04:54,079

is fade to black blend from river moon

1539

01:04:56,750 --> 01:04:54,960

coffee

1540

01:04:58,710 --> 01:04:56,760

just click on the banner at

1541

01:04:59,109 --> 01:04:58,720

jimmychurchradio.com and use the promo

1542

01:05:03,589 --> 01:04:59,119

code

1543

01:05:13,829 --> 01:05:03,599

f2b blend for 15 off of your order today

1544

01:05:17,589 --> 01:05:15,670

hi this is ray sobs here repping the

1545

01:05:18,150 --> 01:05:17,599

planet and you're listening to my good

1546

01:05:21,029 --> 01:05:18,160

friend

1547

01:05:21,990 --> 01:05:21,039

jimmy church fade to black on the game

1548

01:05:25,670 --> 01:05:22,000

changer network

1549

01:05:26,870 --> 01:05:25,680

and the kgra digital broadcast station

1550

01:05:29,950 --> 01:05:26,880

[Music]

1551

01:05:31,109 --> 01:05:29,960

this is toby kebbel you're listening to

1552

01:05:34,150 --> 01:05:31,119

jimmychurchradio.com

1553

01:05:35,349 --> 01:05:34,160

don't hurt me jimmy i'm only little hey

1554

01:05:37,109 --> 01:05:35,359

i'm adrian grenier

1555

01:05:41,670 --> 01:05:37,119

and this is ari gold we're the honey

1556

01:05:45,670 --> 01:05:43,990

hey i'm adrian grenier and i'm ari gold

1557

01:05:47,910 --> 01:05:45,680

we're the honey brothers

1558

01:05:49,829 --> 01:05:47,920

and you're listening to jimmy church a

1559

01:05:51,430 --> 01:05:49,839

revolution

1560

01:05:53,670 --> 01:05:51,440

jimmy church of fade to black and you

1561

01:05:55,430 --> 01:05:53,680

can become an official fate or not by

1562

01:05:59,750 --> 01:05:55,440

just going to our membership

1563

01:06:01,750 --> 01:05:59,760

section at jimmychurchradio.com

1564

01:06:03,190 --> 01:06:01,760

hello this is serena wright taylor from

1565

01:06:05,109 --> 01:06:03,200

conscious life expo

1566

01:06:06,230 --> 01:06:05,119

and you're listening to fade to black

1567

01:06:08,470 --> 01:06:06,240

with jimmy church

1568

01:06:10,589 --> 01:06:08,480

who holds the lucky pony record for the

1569

01:06:14,230 --> 01:06:10,599

best astrological chart since

1570

01:06:15,910 --> 01:06:14,240

1963. true story

1571

01:06:17,589 --> 01:06:15,920

this is micah hanks of the ghrelian

1572

01:06:19,029 --> 01:06:17,599

report and you're listening to jimmy

1573

01:06:20,789 --> 01:06:19,039

church on fade to black

1574

01:06:23,510 --> 01:06:20,799

across the globe on the game changer

1575

01:06:33,460 --> 01:06:23,520

radio network and the one and only kgra

1576

01:06:46,630 --> 01:06:33,470

radio the planet

1577

01:06:50,309 --> 01:06:48,309

welcome back fade to black i am your

1578

01:06:51,349 --> 01:06:50,319

host jimmy church tonight isaac arthur

1579

01:06:55,750 --> 01:06:51,359

is here tomorrow night

1580

01:06:58,549 --> 01:06:55,760

fader night open lines all night long

1581

01:06:59,510 --> 01:06:58,559

tonight feature science with isaac

1582

01:07:02,710 --> 01:06:59,520

arthur

1583

01:07:05,829 --> 01:07:02,720

and right before the break uh

1584

01:07:08,309 --> 01:07:05,839

talking about uh you know probably uh

1585

01:07:09,589 --> 01:07:08,319

you know just to uh take us back to

1586

01:07:13,029 --> 01:07:09,599

where we were

1587

01:07:16,069 --> 01:07:13,039

uh uh measurement and observation the

1588

01:07:19,270 --> 01:07:16,079

the foundation of

1589

01:07:20,390 --> 01:07:19,280

of all of the quantum scientists is it's

1590

01:07:22,870 --> 01:07:20,400

right there

1591

01:07:24,390 --> 01:07:22,880

okay so when we understand that and

1592

01:07:27,829 --> 01:07:24,400

there is no definitions

1593

01:07:29,910 --> 01:07:27,839

isaac but then we get to as we're

1594

01:07:33,829 --> 01:07:29,920

starting to absorb

1595

01:07:37,829 --> 01:07:33,839

what measurement and observation is

1596

01:07:42,950 --> 01:07:37,839

then the wrench gets thrown into this

1597

01:07:45,990 --> 01:07:42,960

which is this that an observation

1598

01:07:48,549 --> 01:07:46,000

of a particle can do

1599

01:07:50,870 --> 01:07:48,559

a couple of things and one of them

1600

01:07:52,309 --> 01:07:50,880

jumping into the multi-world multiverse

1601
01:07:56,549 --> 01:07:52,319
side of things

1602
01:07:59,910 --> 01:07:56,559
is that another duplicate at that moment

1603
01:08:04,230 --> 01:07:59,920
of observation is created

1604
01:08:07,270 --> 01:08:04,240
somewhere else now

1605
01:08:10,630 --> 01:08:07,280
just the suggestion of that is so

1606
01:08:13,670 --> 01:08:10,640
science fiction right it is such a crazy

1607
01:08:17,030 --> 01:08:13,680
thing for somebody normal to

1608
01:08:21,030 --> 01:08:17,040
to even understand because they're not

1609
01:08:23,510 --> 01:08:21,040
uh the physicists of the world are not

1610
01:08:25,110 --> 01:08:23,520
um suggesting something that is

1611
01:08:28,550 --> 01:08:25,120
unbelievable

1612
01:08:31,990 --> 01:08:28,560
right or that you're misunderstanding

1613
01:08:34,550 --> 01:08:32,000

they are saying exactly that right

1614

01:08:36,470 --> 01:08:34,560
right now yes yeah and and the

1615

01:08:40,070 --> 01:08:36,480
observation could be your dog

1616

01:08:42,709 --> 01:08:40,080
right it doesn't or or whatever

1617

01:08:43,349 --> 01:08:42,719
right it's just right anything well

1618

01:08:46,709 --> 01:08:43,359
everything

1619

01:08:49,430 --> 01:08:46,719
yeah right right right now this

1620

01:08:49,829 --> 01:08:49,440
starts to get too much can we simplify

1621

01:08:53,269 --> 01:08:49,839
this

1622

01:08:54,390 --> 01:08:53,279
just a little bit we can the first place

1623

01:08:56,550 --> 01:08:54,400
we had to start though is

1624

01:08:58,390 --> 01:08:56,560
your your hiroshima's cat and that's the

1625

01:08:59,669 --> 01:08:58,400
one with the cats both alive and dead

1626

01:09:01,990 --> 01:08:59,679

simultaneously

1627

01:09:03,590 --> 01:09:02,000

that is the copenhagen interpretation

1628

01:09:04,870 --> 01:09:03,600

that is at odds with the mini wallets

1629

01:09:05,349 --> 01:09:04,880

interpretation there are several

1630

01:09:07,030 --> 01:09:05,359

different

1631

01:09:09,349 --> 01:09:07,040

interpretations of quantum those the two

1632

01:09:11,030 --> 01:09:09,359

well-known ones in many worlds

1633

01:09:12,789 --> 01:09:11,040

the cat's not alive or dead and

1634

01:09:13,269 --> 01:09:12,799

simultaneously there's a universe where

1635

01:09:15,030 --> 01:09:13,279

it's live

1636

01:09:17,030 --> 01:09:15,040

and the universe where it's dead in

1637

01:09:18,470 --> 01:09:17,040

copenhagen it's both until you observe

1638

01:09:19,829 --> 01:09:18,480

it but there's only one universe once

1639

01:09:20,550 --> 01:09:19,839

you observe it it becomes one of those

1640

01:09:22,870 --> 01:09:20,560

things

1641

01:09:25,349 --> 01:09:22,880

and those two are at odds so like there

1642

01:09:28,390 --> 01:09:25,359

is no alive and dead cat in many worlds

1643

01:09:31,669 --> 01:09:28,400

and there's no alternative reality in in

1644

01:09:33,030 --> 01:09:31,679

in copenhagen but uh the idea

1645

01:09:34,870 --> 01:09:33,040

and this could be one that gets people

1646

01:09:37,030 --> 01:09:34,880

sometimes we're not saying that the new

1647

01:09:38,709 --> 01:09:37,040

universe has been created out of nowhere

1648

01:09:40,870 --> 01:09:38,719

uh in the sense of like some whole new

1649

01:09:43,110 --> 01:09:40,880

universe is being produced out of out of

1650

01:09:44,630 --> 01:09:43,120

absolute nothingness uh there's no

1651
01:09:46,070 --> 01:09:44,640
energy violation going on there in terms

1652
01:09:47,030 --> 01:09:46,080
of like a whole new universe it's always

1653
01:09:48,390 --> 01:09:47,040
energy appealing

1654
01:09:50,390 --> 01:09:48,400
we're saying they kind of always existed

1655
01:09:51,829 --> 01:09:50,400
that they're always going to existed

1656
01:09:53,749 --> 01:09:51,839
and that it's kind of that we're only

1657
01:09:54,310 --> 01:09:53,759
seeing the pits of all dimensions that

1658
01:09:56,310 --> 01:09:54,320
uh

1659
01:09:58,149 --> 01:09:56,320
like imagine a million sheets of paper

1660
01:09:59,430 --> 01:09:58,159
each of its own little ward line and

1661
01:10:01,110 --> 01:09:59,440
theories of events going on they're just

1662
01:10:02,149 --> 01:10:01,120
stacked next to each other and they

1663
01:10:02,470 --> 01:10:02,159

overlap in a couple places where you

1664

01:10:05,830 --> 01:10:02,480

have

1665

01:10:07,669 --> 01:10:05,840

these different alternate futures

1666

01:10:09,189 --> 01:10:07,679

and you also have ultimate past too

1667

01:10:11,030 --> 01:10:09,199

which is something we don't really talk

1668

01:10:13,270 --> 01:10:11,040

to talk about as much but also follows

1669

01:10:16,070 --> 01:10:13,280

from most those interpretations too

1670

01:10:17,430 --> 01:10:16,080

is that same as one event can lead to

1671

01:10:19,590 --> 01:10:17,440

many different futures

1672

01:10:21,110 --> 01:10:19,600

uh depending on how it happens a given

1673

01:10:21,669 --> 01:10:21,120

moment of time could have had many

1674

01:10:23,750 --> 01:10:21,679

different

1675

01:10:24,950 --> 01:10:23,760

paths that all led up to the same event

1676

01:10:26,870 --> 01:10:24,960

you know the the

1677

01:10:28,229 --> 01:10:26,880

a bit of water rolls downhill from any

1678

01:10:29,189 --> 01:10:28,239

even side of a crater still gets to the

1679

01:10:32,070 --> 01:10:29,199

bottom

1680

01:10:32,950 --> 01:10:32,080

um so that at any given moment it's more

1681

01:10:34,550 --> 01:10:32,960

like you're

1682

01:10:36,390 --> 01:10:34,560

even a bunch of strings stretching from

1683

01:10:37,990 --> 01:10:36,400

a ceiling like on a loom

1684

01:10:39,270 --> 01:10:38,000

and you put a ring around all those and

1685

01:10:40,630 --> 01:10:39,280

that you know the horizontal together

1686

01:10:42,790 --> 01:10:40,640

nice and tight where you're at they

1687

01:10:44,229 --> 01:10:42,800

stretch out the sides front and back

1688

01:10:46,149 --> 01:10:44,239

that ring might be the current event

1689

01:10:47,750 --> 01:10:46,159

you're in and all those road lines

1690

01:10:48,709 --> 01:10:47,760

branch off forward and backwards when

1691

01:10:50,070 --> 01:10:48,719

you're in time

1692

01:10:52,790 --> 01:10:50,080

but the kind of notion is you're really

1693

01:10:55,510 --> 01:10:52,800

more navigating your way through

1694

01:10:56,870 --> 01:10:55,520

every single possible configuration of

1695

01:10:59,910 --> 01:10:56,880

matter and energy

1696

01:11:01,110 --> 01:10:59,920

at all and so your universe your ward

1697

01:11:03,110 --> 01:11:01,120

line or you would

1698

01:11:04,470 --> 01:11:03,120

think of it as is basically just the

1699

01:11:06,229 --> 01:11:04,480

path you take through

1700

01:11:07,510 --> 01:11:06,239

every possible conceivable state all of

1701

01:11:09,590 --> 01:11:07,520

which do exist

1702

01:11:11,030 --> 01:11:09,600

that is one version of many wars there's

1703

01:11:13,270 --> 01:11:11,040

a lot of versions of that too but

1704

01:11:14,470 --> 01:11:13,280

uh we can't prove any of them we don't

1705

01:11:16,790 --> 01:11:14,480

have any evidence

1706

01:11:18,550 --> 01:11:16,800

saying which one is which we know what

1707

01:11:19,590 --> 01:11:18,560

the matter seems to do

1708

01:11:21,510 --> 01:11:19,600

and we know that each of those

1709

01:11:23,030 --> 01:11:21,520

interpretations and most the other ones

1710

01:11:25,030 --> 01:11:23,040

properly explain it

1711

01:11:26,390 --> 01:11:25,040

but we can't verify which one it is we

1712

01:11:27,430 --> 01:11:26,400

don't know if it's cooked bacon we don't

1713

01:11:28,950 --> 01:11:27,440

have as many words

1714

01:11:30,550 --> 01:11:28,960

we know if it's one of the other ones

1715

01:11:32,149 --> 01:11:30,560

and there isn't any

1716

01:11:35,669 --> 01:11:32,159

evidence backing any of them at this

1717

01:11:40,310 --> 01:11:35,679

time in terms of which one it might be

1718

01:11:44,229 --> 01:11:40,320

the the observation of said particle

1719

01:11:47,910 --> 01:11:44,239

and and creating at that moment at that

1720

01:11:51,270 --> 01:11:47,920

exact moment uh another identical

1721

01:11:52,390 --> 01:11:51,280

particle is this what brings in the

1722

01:11:55,830 --> 01:11:52,400

possibility

1723

01:11:59,030 --> 01:11:55,840

of not only the multiverse but

1724

01:12:02,070 --> 01:11:59,040

uh alternate versions of you and

1725

01:12:04,070 --> 01:12:02,080

if that is the case one has to ask

1726

01:12:06,149 --> 01:12:04,080

where are these worlds physically where

1727

01:12:08,870 --> 01:12:06,159

do they exist

1728

01:12:09,669 --> 01:12:08,880

and why don't we see them right angles

1729

01:12:11,750 --> 01:12:09,679

to reality

1730

01:12:13,189 --> 01:12:11,760

uh there is a thought inside string

1731

01:12:14,229 --> 01:12:13,199

theory for instance which is another

1732

01:12:15,270 --> 01:12:14,239

theory that we don't have any evidence

1733

01:12:17,430 --> 01:12:15,280

to back up

1734

01:12:19,189 --> 01:12:17,440

that we can only really see the three

1735

01:12:20,630 --> 01:12:19,199

you know dimensions around us that are

1736

01:12:23,030 --> 01:12:20,640

physical dimensions but they also have

1737

01:12:26,070 --> 01:12:23,040

the ones going if you would up or down

1738

01:12:28,149 --> 01:12:26,080

or left left or right angles to reality

1739

01:12:29,910 --> 01:12:28,159

you know a spin board um whatever you

1740

01:12:31,350 --> 01:12:29,920

for that these are actually things you

1741

01:12:33,270 --> 01:12:31,360

could step to back and forth between

1742

01:12:35,430 --> 01:12:33,280

them like brains

1743

01:12:37,189 --> 01:12:35,440

they refer to membranes of reality on

1744

01:12:39,510 --> 01:12:37,199

which universes might lie

1745

01:12:41,350 --> 01:12:39,520

but again we don't know any way to get

1746

01:12:43,350 --> 01:12:41,360

back and forth between them

1747

01:12:44,870 --> 01:12:43,360

and there's no guarantee that you really

1748

01:12:46,229 --> 01:12:44,880

are getting anything back and forth

1749

01:12:47,590 --> 01:12:46,239

between them either

1750

01:12:49,590 --> 01:12:47,600

but if we could find a way to trap

1751

01:12:52,070 --> 01:12:49,600

between them might be very handy

1752

01:12:52,630 --> 01:12:52,080

but in theory there's just so many of

1753

01:12:55,750 --> 01:12:52,640

them

1754

01:12:56,950 --> 01:12:55,760

if every possible every single possible

1755

01:12:58,950 --> 01:12:56,960

state is possible

1756

01:13:00,070 --> 01:12:58,960

i think it would have to be 10 to the 10

1757

01:13:03,350 --> 01:13:00,080

to 77

1758

01:13:05,590 --> 01:13:03,360

possible options and that's just for one

1759

01:13:06,470 --> 01:13:05,600

observable universe and we have no real

1760

01:13:07,590 --> 01:13:06,480

reason to think that would be the

1761

01:13:08,790 --> 01:13:07,600

limitation on it either

1762

01:13:10,870 --> 01:13:08,800

you know our observable universe is

1763

01:13:12,310 --> 01:13:10,880

probably only a very tiny portion of the

1764

01:13:14,310 --> 01:13:12,320

this universe which has nothing to do

1765

01:13:15,830 --> 01:13:14,320

with the other alternate realities

1766

01:13:17,270 --> 01:13:15,840

although if this universe is infinite

1767

01:13:18,709 --> 01:13:17,280

you'd also have the exact same effect

1768

01:13:19,430 --> 01:13:18,719

there where everything possible it also

1769

01:13:21,590 --> 01:13:19,440

happened

1770

01:13:23,510 --> 01:13:21,600

well and that number is so big you might

1771

01:13:25,110 --> 01:13:23,520

as well call it infinite

1772

01:13:26,709 --> 01:13:25,120

yeah i mean after you load it down on

1773

01:13:29,990 --> 01:13:26,719

paper or collapse into a black hole

1774

01:13:34,550 --> 01:13:30,000

yes you that is a big big

1775

01:13:37,830 --> 01:13:34,560

number okay then there is

1776

01:13:39,990 --> 01:13:37,840

the question of entanglement

1777

01:13:41,910 --> 01:13:40,000

which all happens at the same part of

1778

01:13:45,430 --> 01:13:41,920

this conversation

1779

01:13:48,470 --> 01:13:45,440

so the observation happens

1780

01:13:51,750 --> 01:13:48,480

and the particle

1781

01:13:52,470 --> 01:13:51,760

is created and at that point that

1782

01:13:57,510 --> 01:13:52,480

particle

1783

01:14:04,470 --> 01:14:01,110

okay let's let's start there

1784

01:14:04,950 --> 01:14:04,480

when i hear a physicist say and this was

1785

01:14:07,590 --> 01:14:04,960

of course

1786

01:14:08,070 --> 01:14:07,600

einstein's spooky action at a distance

1787

01:14:11,270 --> 01:14:08,080

comment

1788

01:14:13,669 --> 01:14:11,280

right okay when when that happens and

1789

01:14:16,630 --> 01:14:13,679

the entangled particles are there

1790

01:14:17,110 --> 01:14:16,640

and a physicist says something crazy

1791

01:14:19,590 --> 01:14:17,120

like

1792

01:14:20,790 --> 01:14:19,600

this it doesn't matter about the

1793

01:14:23,189 --> 01:14:20,800

distance

1794

01:14:24,790 --> 01:14:23,199

it could be close it could be on the

1795

01:14:28,149 --> 01:14:24,800

other side of the galaxy

1796

01:14:31,910 --> 01:14:28,159

or the other side of the universe

1797

01:14:35,030 --> 01:14:31,920

but the interaction is instant

1798

01:14:36,070 --> 01:14:35,040

now how is it there is no measurement or

1799

01:14:37,590 --> 01:14:36,080

observation

1800

01:14:39,669 --> 01:14:37,600

of a particle on the other side of the

1801
01:14:41,110 --> 01:14:39,679
galaxy or on the other side of the solar

1802
01:14:43,270 --> 01:14:41,120
system

1803
01:14:44,709 --> 01:14:43,280
we know it's very very fast but we

1804
01:14:46,229 --> 01:14:44,719
haven't actually proven it's instant yet

1805
01:14:47,910 --> 01:14:46,239
that would be very hard to prove which

1806
01:14:49,510 --> 01:14:47,920
should be a very short period of time

1807
01:14:51,669 --> 01:14:49,520
for instance anytime you're trying to

1808
01:14:53,270 --> 01:14:51,679
prove anything involves zero or infinity

1809
01:14:56,149 --> 01:14:53,280
it gets very difficult

1810
01:14:57,830 --> 01:14:56,159
but um an analogy i use that it's not

1811
01:14:59,189 --> 01:14:57,840
the best from a strictly

1812
01:15:00,950 --> 01:14:59,199
theoretical standpoint but it works

1813
01:15:01,990 --> 01:15:00,960

pretty well as when we create two

1814

01:15:03,350 --> 01:15:02,000

particles or we do

1815

01:15:05,030 --> 01:15:03,360

something that causes two or more

1816

01:15:07,350 --> 01:15:05,040

particles we involve like a

1817

01:15:09,270 --> 01:15:07,360

an up and down anti-particle pair come

1818

01:15:10,470 --> 01:15:09,280

into existence those are entangled until

1819

01:15:12,630 --> 01:15:10,480

we observe one

1820

01:15:14,070 --> 01:15:12,640

and they have a pair of features they're

1821

01:15:15,669 --> 01:15:14,080

gonna have to be matched up basically

1822

01:15:17,510 --> 01:15:15,679

they might have to equate to zero

1823

01:15:19,110 --> 01:15:17,520

one is spinning up or the other spinning

1824

01:15:20,709 --> 01:15:19,120

downward or clockwise and

1825

01:15:22,390 --> 01:15:20,719

counterclockwise before

1826

01:15:23,669 --> 01:15:22,400

uh and we don't know which one's which

1827

01:15:23,990 --> 01:15:23,679

and the quantum quantum's telling us

1828

01:15:27,110 --> 01:15:24,000

that

1829

01:15:28,550 --> 01:15:27,120

hasn't been torment they'll both

1830

01:15:30,870 --> 01:15:28,560

simultaneously

1831

01:15:32,229 --> 01:15:30,880

both of those until we actually check

1832

01:15:33,750 --> 01:15:32,239

that's copenhagen

1833

01:15:35,030 --> 01:15:33,760

many words that actually is in the case

1834

01:15:36,550 --> 01:15:35,040

there's one what's up and one where it's

1835

01:15:39,990 --> 01:15:36,560

down and there's no evils where it's

1836

01:15:42,310 --> 01:15:40,000

flipped but um we think that

1837

01:15:43,669 --> 01:15:42,320

is decided instantaneously or at least

1838

01:15:45,910 --> 01:15:43,679

you can determine them instantaneously

1839

01:15:47,270 --> 01:15:45,920

but the analogy i use to try to make it

1840

01:15:50,390 --> 01:15:47,280

a little bit more understandable in a

1841

01:15:51,990 --> 01:15:50,400

real world context is imagine if i had a

1842

01:15:53,510 --> 01:15:52,000

piece of paper under which i'd written a

1843

01:15:54,550 --> 01:15:53,520

zero and a one i ripped that sheet of

1844

01:15:55,990 --> 01:15:54,560

paper in half

1845

01:15:58,630 --> 01:15:56,000

and i attached a note to it in a letter

1846

01:16:01,270 --> 01:15:58,640

that said i've written zero or one

1847

01:16:02,870 --> 01:16:01,280

on two letters i'm sending you one i'm

1848

01:16:05,270 --> 01:16:02,880

saying another to your friend

1849

01:16:05,990 --> 01:16:05,280

who lives on alpha centauri the moment

1850

01:16:07,910 --> 01:16:06,000

you open that letter

1851
01:16:09,510 --> 01:16:07,920
up in c one and the explanation you know

1852
01:16:10,630 --> 01:16:09,520
the other guy has a zero

1853
01:16:12,229 --> 01:16:10,640
even though you can't have that

1854
01:16:13,430 --> 01:16:12,239
confirmed for the four years it takes

1855
01:16:16,229 --> 01:16:13,440
him to send that message

1856
01:16:17,990 --> 01:16:16,239
at the stage of light right right yes so

1857
01:16:18,709 --> 01:16:18,000
but you know that instantaneously that

1858
01:16:20,390 --> 01:16:18,719
information has

1859
01:16:22,470 --> 01:16:20,400
traveled to you faster than the speed of

1860
01:16:24,390 --> 01:16:22,480
light you know what the answer is to it

1861
01:16:26,310 --> 01:16:24,400
um it's that's a trivial example of

1862
01:16:27,669 --> 01:16:26,320
course but what we're saying is that's

1863
01:16:28,470 --> 01:16:27,679

what's happening with these particles

1864

01:16:30,709 --> 01:16:28,480

only

1865

01:16:32,550 --> 01:16:30,719

is spooky because they're actually not

1866

01:16:35,430 --> 01:16:32,560

determined yet that letter

1867

01:16:36,070 --> 01:16:35,440

was a zero to one it always was right uh

1868

01:16:38,709 --> 01:16:36,080

these were

1869

01:16:40,149 --> 01:16:38,719

zero and a one both until i opened it up

1870

01:16:40,950 --> 01:16:40,159

and now the other one on the other side

1871

01:16:43,110 --> 01:16:40,960

of the universe

1872

01:16:44,550 --> 01:16:43,120

knows it's the other one the one was a

1873

01:16:45,590 --> 01:16:44,560

zero and one this was zero one i opened

1874

01:16:47,189 --> 01:16:45,600

up it says zero

1875

01:16:48,790 --> 01:16:47,199

other side the universe summoned his us

1876

01:16:50,550 --> 01:16:48,800

only says one

1877

01:16:53,110 --> 01:16:50,560

that's what is being said by the spooky

1878

01:16:55,030 --> 01:16:53,120

action of distance same analogy but

1879

01:16:56,229 --> 01:16:55,040

what's the mechanism of transit and we

1880

01:16:58,149 --> 01:16:56,239

don't know i think um

1881

01:16:59,350 --> 01:16:58,159

i can't was name at the moment and i

1882

01:17:00,229 --> 01:16:59,360

should but he was suggesting he might

1883

01:17:02,390 --> 01:17:00,239

have uh

1884

01:17:04,630 --> 01:17:02,400

wormholes alone suits again that might

1885

01:17:07,990 --> 01:17:04,640

be little tiny wormholes that's the uh

1886

01:17:10,950 --> 01:17:08,000

ep equals eprp uh theory presented

1887

01:17:12,310 --> 01:17:10,960

and um that's one of the more

1888

01:17:13,590 --> 01:17:12,320

interesting studies i've heard for it

1889

01:17:14,470 --> 01:17:13,600

but the question is always how do we

1890

01:17:17,669 --> 01:17:14,480

prove this

1891

01:17:18,870 --> 01:17:17,679

and it's been something that we haven't

1892

01:17:20,709 --> 01:17:18,880

been able to figure out yet is how to

1893

01:17:21,189 --> 01:17:20,719

actually create approval test to find

1894

01:17:22,390 --> 01:17:21,199

out

1895

01:17:24,390 --> 01:17:22,400

which of these interpretations of

1896

01:17:26,390 --> 01:17:24,400

quantum is right and uh

1897

01:17:27,830 --> 01:17:26,400

to figure out again why does it do this

1898

01:17:29,830 --> 01:17:27,840

we don't know

1899

01:17:32,390 --> 01:17:29,840

couldn't you do it with a deck of cards

1900

01:17:36,550 --> 01:17:32,400

and you and i sitting in the same room

1901
01:17:39,350 --> 01:17:36,560
and you know that we both have hearts

1902
01:17:40,630 --> 01:17:39,360
or we both don't yeah if you're

1903
01:17:42,070 --> 01:17:40,640
essentially counting college you know

1904
01:17:42,790 --> 01:17:42,080
which one the other guy had but the

1905
01:17:44,550 --> 01:17:42,800
thing is

1906
01:17:46,149 --> 01:17:44,560
you would always have had that code it

1907
01:17:49,110 --> 01:17:46,159
didn't change magically

1908
01:17:50,630 --> 01:17:49,120
um you know the notion here is that i'm

1909
01:17:52,550 --> 01:17:50,640
holding the you know the one-eyed jack

1910
01:17:54,390 --> 01:17:52,560
in my hand you got a two-eye jack

1911
01:17:55,910 --> 01:17:54,400
uh and so i know that i've got one

1912
01:17:57,270 --> 01:17:55,920
because you have the other one

1913
01:17:59,110 --> 01:17:57,280

but what we're saying here is that i

1914

01:18:00,709 --> 01:17:59,120

didn't know which one mine was and it

1915

01:18:02,550 --> 01:18:00,719

really wasn't determined until i looked

1916

01:18:04,390 --> 01:18:02,560

at it that's my mouth

1917

01:18:07,430 --> 01:18:04,400

yes exactly couldn't we do that with a

1918

01:18:09,030 --> 01:18:07,440

deck of cards keep them face down

1919

01:18:10,390 --> 01:18:09,040

well you can't really entangle something

1920

01:18:12,229 --> 01:18:10,400

as big as well at least we can't

1921

01:18:13,590 --> 01:18:12,239

integrate something that big yet so well

1922

01:18:16,630 --> 01:18:13,600

we have to work with individual atoms

1923

01:18:18,630 --> 01:18:16,640

now that takes me to my next question

1924

01:18:19,830 --> 01:18:18,640

nice segue you should do this for a

1925

01:18:24,390 --> 01:18:19,840

living by the way

1926

01:18:27,669 --> 01:18:24,400
uh you're really good is this um

1927

01:18:31,270 --> 01:18:27,679
how tall are you five nine

1928

01:18:34,870 --> 01:18:31,280
you're five nine and and

1929

01:18:38,630 --> 01:18:34,880
what's your what's your weight 220

1930

01:18:42,950 --> 01:18:38,640
220 that's a lot of particles

1931

01:18:46,790 --> 01:18:42,960
right yes am i observing you right now

1932

01:18:48,229 --> 01:18:46,800
i am wait wait wait okay let's pretend

1933

01:18:49,669 --> 01:18:48,239
we're in the same room

1934

01:18:52,470 --> 01:18:49,679
right now i feel like we're in the same

1935

01:18:55,830 --> 01:18:52,480
room and i i look at you

1936

01:18:59,070 --> 01:18:55,840
you look at me are we now

1937

01:19:02,149 --> 01:18:59,080
particle for particle

1938

01:19:05,750 --> 01:19:02,159

recreated instantaneously

1939

01:19:06,550 --> 01:19:05,760

somewhere else i don't think we could

1940

01:19:09,030 --> 01:19:06,560

say it that way

1941

01:19:11,669 --> 01:19:09,040

you know we we can say the well what do

1942

01:19:14,070 --> 01:19:11,679

we mean by weak

1943

01:19:16,310 --> 01:19:14,080

you're made of the same particles as all

1944

01:19:16,950 --> 01:19:16,320

the other particles as far as i know you

1945

01:19:19,669 --> 01:19:16,960

don't

1946

01:19:20,870 --> 01:19:19,679

have a makeup of special particles we

1947

01:19:22,310 --> 01:19:20,880

assume that yeah i mean we don't

1948

01:19:23,830 --> 01:19:22,320

technically have a way of checking

1949

01:19:25,669 --> 01:19:23,840

without checking me individually but we

1950

01:19:27,669 --> 01:19:25,679

assume that i made the same basic matter

1951

01:19:30,950 --> 01:19:27,679

as every other object in this room and

1952

01:19:32,470 --> 01:19:30,960

in the universe um but uh how that

1953

01:19:33,830 --> 01:19:32,480

information is transmit in our case well

1954

01:19:35,030 --> 01:19:33,840

we know what's going on

1955

01:19:36,790 --> 01:19:35,040

photons are being absorbed by

1956

01:19:37,990 --> 01:19:36,800

semiconductors they would get turned

1957

01:19:40,390 --> 01:19:38,000

into an electrical signal

1958

01:19:41,430 --> 01:19:40,400

et cetera are sent to the screen uh that

1959

01:19:43,189 --> 01:19:41,440

same kind of thing is basically what's

1960

01:19:44,630 --> 01:19:43,199

happening with your eyeballs too they're

1961

01:19:46,229 --> 01:19:44,640

photons will be absorbed by your

1962

01:19:47,510 --> 01:19:46,239

eyeballs in the cones

1963

01:19:48,550 --> 01:19:47,520

i don't know if those are natural

1964

01:19:49,750 --> 01:19:48,560
semiconductors because i'm not an

1965

01:19:51,910 --> 01:19:49,760
optometrist

1966

01:19:53,189 --> 01:19:51,920
but uh same basic process electric

1967

01:19:55,030 --> 01:19:53,199
signal sent to your brain

1968

01:19:56,630 --> 01:19:55,040
interpreted as an image it's an

1969

01:19:59,030 --> 01:19:56,640
amazingly complex process

1970

01:20:00,630 --> 01:19:59,040
but it does seem to do a good job of

1971

01:20:01,990 --> 01:20:00,640
relaying the image but of course the

1972

01:20:03,430 --> 01:20:02,000
image is not accurate

1973

01:20:05,350 --> 01:20:03,440
we think of each other by the image we

1974

01:20:08,629 --> 01:20:05,360
produce it but that's a very inaccurate

1975

01:20:09,750 --> 01:20:08,639
real image we all share that a visual

1976

01:20:11,510 --> 01:20:09,760

look at me but i'm not seeing you in

1977

01:20:12,470 --> 01:20:11,520

infrared for instance or ultraviolet or

1978

01:20:17,590 --> 01:20:12,480

radio

1979

01:20:19,669 --> 01:20:17,600

um you know we do audio strictly by

1980

01:20:21,750 --> 01:20:19,679

you know sound but like a cat they have

1981

01:20:23,030 --> 01:20:21,760

stereoscopic hearing they they're more

1982

01:20:23,750 --> 01:20:23,040

of a three-dimensional image of what's

1983

01:20:26,310 --> 01:20:23,760

going on

1984

01:20:27,990 --> 01:20:26,320

their reality is different than ours

1985

01:20:29,830 --> 01:20:28,000

they can't see as many colors as us i

1986

01:20:31,590 --> 01:20:29,840

remember we saw as they're dichromatic

1987

01:20:33,590 --> 01:20:31,600

uh we're try chromatic we see three

1988

01:20:35,189 --> 01:20:33,600

colors red green blue they see

1989

01:20:36,709 --> 01:20:35,199

i'm not sure which ones but dear for

1990

01:20:38,390 --> 01:20:36,719

instance can't see orange

1991

01:20:40,950 --> 01:20:38,400

very different universe in that they

1992

01:20:42,470 --> 01:20:40,960

observe than us same place we assume but

1993

01:20:44,390 --> 01:20:42,480

neither one of them is really all that

1994

01:20:47,990 --> 01:20:44,400

real it's a very limited

1995

01:20:51,030 --> 01:20:48,000

view onto reality but if we

1996

01:20:54,709 --> 01:20:51,040

yes okay so if we take uh

1997

01:20:58,390 --> 01:20:54,719

let's just go with observation and we go

1998

01:21:01,350 --> 01:20:58,400

with entanglement and we are observing

1999

01:21:01,910 --> 01:21:01,360

each other and particles or particles

2000

01:21:04,790 --> 01:21:01,920

then

2001
01:21:05,510 --> 01:21:04,800
that would say to me or anybody else

2002
01:21:07,750 --> 01:21:05,520
that's being

2003
01:21:08,870 --> 01:21:07,760
rational about these thoughts and

2004
01:21:12,310 --> 01:21:08,880
theories

2005
01:21:16,550 --> 01:21:12,320
is that there is now

2006
01:21:20,229 --> 01:21:16,560
an entangled version of you

2007
01:21:22,070 --> 01:21:20,239
there would have to be no uh well

2008
01:21:23,910 --> 01:21:22,080
every time you absorb something in the

2009
01:21:26,390 --> 01:21:23,920
entangle when it was had is over

2010
01:21:28,310 --> 01:21:26,400
right the entanglement is is a st

2011
01:21:29,910 --> 01:21:28,320
something creates an entangled state

2012
01:21:31,590 --> 01:21:29,920
right a state being whatever the

2013
01:21:33,030 --> 01:21:31,600

particles happen to be in

2014

01:21:35,110 --> 01:21:33,040

how they're lined up how the deck is

2015

01:21:38,070 --> 01:21:35,120

shuffled the moment you absorb it

2016

01:21:39,270 --> 01:21:38,080

you pull a card over the entanglement is

2017

01:21:40,950 --> 01:21:39,280

over

2018

01:21:42,790 --> 01:21:40,960

you can recreate another entanglement

2019

01:21:44,709 --> 01:21:42,800

but that entanglement is done

2020

01:21:46,149 --> 01:21:44,719

so for instance if i was observing you

2021

01:21:47,350 --> 01:21:46,159

and you were entangled

2022

01:21:49,030 --> 01:21:47,360

then when i observe you that

2023

01:21:50,229 --> 01:21:49,040

entanglement ceases now new

2024

01:21:51,669 --> 01:21:50,239

entanglements are going on

2025

01:21:53,110 --> 01:21:51,679

doubtless but the one that we

2026

01:21:54,470 --> 01:21:53,120

specifically created will end the moment

2027

01:21:56,390 --> 01:21:54,480

we absorb it

2028

01:21:58,229 --> 01:21:56,400

although not necessarily the moment we

2029

01:22:01,189 --> 01:21:58,239

resolve it because

2030

01:22:02,629 --> 01:22:01,199

it can potentially be backward in time

2031

01:22:03,830 --> 01:22:02,639

too

2032

01:22:05,990 --> 01:22:03,840

that's probably a conversation for

2033

01:22:07,990 --> 01:22:06,000

another time well and so

2034

01:22:09,830 --> 01:22:08,000

exactly and if we take these concepts

2035

01:22:11,669 --> 01:22:09,840

and you even go back to the simplicity

2036

01:22:15,430 --> 01:22:11,679

of schrodinger's cat

2037

01:22:18,629 --> 01:22:15,440

you're observing a cat i'm observing you

2038

01:22:19,990 --> 01:22:18,639

so right and we have one of them ignores

2039

01:22:20,550 --> 01:22:20,000

one what if the guy who's observing the

2040

01:22:22,629 --> 01:22:20,560

cat

2041

01:22:25,189 --> 01:22:22,639

is in a room with the door shut that's

2042

01:22:26,870 --> 01:22:25,199

right yes

2043

01:22:28,390 --> 01:22:26,880

right who was doing the absorbing right

2044

01:22:29,669 --> 01:22:28,400

who was doing who was the ultimate

2045

01:22:32,390 --> 01:22:29,679

observer was another case too

2046

01:22:33,750 --> 01:22:32,400

is it it does the universe change like

2047

01:22:34,870 --> 01:22:33,760

we've determined if the cat's alive or

2048

01:22:36,470 --> 01:22:34,880

dead here on earth

2049

01:22:38,470 --> 01:22:36,480

but someone who's observing earth from a

2050

01:22:40,470 --> 01:22:38,480

billion light years away hasn't yet

2051
01:22:42,310 --> 01:22:40,480
so that cash should still be entangled

2052
01:22:43,030 --> 01:22:42,320
we think maybe that cat is still alive

2053
01:22:44,709 --> 01:22:43,040
and dead

2054
01:22:46,310 --> 01:22:44,719
and i'm still either sad or happy that

2055
01:22:47,669 --> 01:22:46,320
my cat is dead that hasn't been

2056
01:22:48,550 --> 01:22:47,679
determined yet a guy a billion light

2057
01:22:49,910 --> 01:22:48,560
years away

2058
01:22:52,229 --> 01:22:49,920
looks at it and now it's determined for

2059
01:22:55,590 --> 01:22:52,239
him was i still

2060
01:22:58,709 --> 01:22:55,600
in a state of both until he absorbed me

2061
01:23:01,750 --> 01:22:58,719
we don't know you know it's it's um

2062
01:23:04,709 --> 01:23:01,760
is there a final you know is there

2063
01:23:05,669 --> 01:23:04,719

a event that is actually solid say

2064

01:23:06,870 --> 01:23:05,679

something where the event has

2065

01:23:07,669 --> 01:23:06,880

specifically happened and it's now

2066

01:23:09,910 --> 01:23:07,679

occurred

2067

01:23:11,990 --> 01:23:09,920

or is it always blowing around like that

2068

01:23:14,149 --> 01:23:12,000

and not determined until someone sees it

2069

01:23:16,390 --> 01:23:14,159

what qualifies as a legitimate observer

2070

01:23:19,189 --> 01:23:16,400

and what makes an observer is it just

2071

01:23:20,790 --> 01:23:19,199

an event or does the observer require a

2072

01:23:22,149 --> 01:23:20,800

special quality

2073

01:23:23,590 --> 01:23:22,159

is there such a real thing as an

2074

01:23:24,950 --> 01:23:23,600

observer as opposed to just some other

2075

01:23:28,470 --> 01:23:24,960

event taking place

2076

01:23:32,070 --> 01:23:28,480

have you ever uh pondered

2077

01:23:34,229 --> 01:23:32,080

if if all of this plays out

2078

01:23:36,790 --> 01:23:34,239

right can't prove a la you know we may

2079

01:23:40,070 --> 01:23:36,800

never prove a lot of this

2080

01:23:41,430 --> 01:23:40,080

but the equations in the math say it is

2081

01:23:44,709 --> 01:23:41,440

so

2082

01:23:48,390 --> 01:23:44,719

that maybe ghosts

2083

01:23:50,629 --> 01:23:48,400

are part of physics are part

2084

01:23:51,990 --> 01:23:50,639

of these dimensions that are

2085

01:23:53,830 --> 01:23:52,000

immeasurable

2086

01:23:56,950 --> 01:23:53,840

and we have ghost particles and virtual

2087

01:23:59,110 --> 01:23:56,960

particles built into the theory

2088

01:24:00,950 --> 01:23:59,120

you got to throw that in okay but yeah

2089

01:24:01,270 --> 01:24:00,960

but have you ever wondered about that

2090

01:24:02,550 --> 01:24:01,280

that

2091

01:24:04,470 --> 01:24:02,560

all of these multi-worlds and

2092

01:24:07,189 --> 01:24:04,480

multiverses and things

2093

01:24:09,270 --> 01:24:07,199

may be some of these other parts of the

2094

01:24:12,229 --> 01:24:09,280

paranormal and supernatural

2095

01:24:14,149 --> 01:24:12,239

that we've apparently been seeing right

2096

01:24:15,030 --> 01:24:14,159

trying to be as as rational as you can

2097

01:24:16,550 --> 01:24:15,040

about it because

2098

01:24:18,790 --> 01:24:16,560

it's not so much that that's necessarily

2099

01:24:20,149 --> 01:24:18,800

right you go into these things skeptical

2100

01:24:21,830 --> 01:24:20,159

to some degree it's almost the only way

2101

01:24:23,350 --> 01:24:21,840

to maintain sanity

2102

01:24:24,950 --> 01:24:23,360

no one goes into something like physics

2103

01:24:25,830 --> 01:24:24,960

without trying to be basically your

2104

01:24:27,110 --> 01:24:25,840

motive by

2105

01:24:28,229 --> 01:24:27,120

the universe is a strange place and i

2106

01:24:29,189 --> 01:24:28,239

want to understand it it's beautiful

2107

01:24:30,950 --> 01:24:29,199

it's wonderful

2108

01:24:32,709 --> 01:24:30,960

i want to know more about it so you

2109

01:24:34,870 --> 01:24:32,719

should be going into saying things like

2110

01:24:36,149 --> 01:24:34,880

ghosts might exist yet you might exist

2111

01:24:36,950 --> 01:24:36,159

all these things should come to you as

2112

01:24:38,709 --> 01:24:36,960

saying

2113

01:24:39,990 --> 01:24:38,719

i hope they do what a cool universe will

2114

01:24:41,350 --> 01:24:40,000

be right but she's gonna have to

2115

01:24:42,830 --> 01:24:41,360

approach us skeptically

2116

01:24:45,590 --> 01:24:42,840

both because that's good science and

2117

01:24:46,950 --> 01:24:45,600

because you know you you will go through

2118

01:24:48,310 --> 01:24:46,960

any number of if you're applying to

2119

01:24:49,669 --> 01:24:48,320

major in physics prepare to just go

2120

01:24:51,750 --> 01:24:49,679

through existential crisis after

2121

01:24:53,189 --> 01:24:51,760

existential crisis until you get them to

2122

01:24:57,189 --> 01:24:53,199

the point where it's like

2123

01:25:00,550 --> 01:24:57,199

walking you just get used to it and and

2124

01:25:02,709 --> 01:25:00,560

how is it possible uh to be

2125

01:25:04,229 --> 01:25:02,719

pragmatic and black and white in the

2126

01:25:07,430 --> 01:25:04,239

hard scientists

2127

01:25:08,550 --> 01:25:07,440

sciences as a physicist right because

2128

01:25:12,070 --> 01:25:08,560

it's the numbers

2129

01:25:14,550 --> 01:25:12,080

that you believe in how is it possible

2130

01:25:16,470 --> 01:25:14,560

to be to stay pragmatic when you're

2131

01:25:18,470 --> 01:25:16,480

talking about the multiverse

2132

01:25:21,030 --> 01:25:18,480

when you're talking about schrodinger's

2133

01:25:24,830 --> 01:25:21,040

cat you're talking about entanglement

2134

01:25:27,510 --> 01:25:24,840

where we're getting way out there in

2135

01:25:28,790 --> 01:25:27,520

concept um i mean i guess to some degree

2136

01:25:29,550 --> 01:25:28,800

probably the psychologist's answer would

2137

01:25:30,709 --> 01:25:29,560

be you get really good at

2138

01:25:34,390 --> 01:25:30,719

compartmentalizing

2139

01:25:36,229 --> 01:25:34,400

but uh you know it is uh

2140

01:25:37,910 --> 01:25:36,239

it again how does any of us deal with

2141

01:25:39,430 --> 01:25:37,920

these things you know we all

2142

01:25:40,629 --> 01:25:39,440

at least i hope we all get a chance in

2143

01:25:42,390 --> 01:25:40,639

life to spend a lot of time thinking

2144

01:25:44,310 --> 01:25:42,400

about all these strange aspects of

2145

01:25:46,310 --> 01:25:44,320

reality in which we live

2146

01:25:48,070 --> 01:25:46,320

and you know of course how do you get up

2147

01:25:49,270 --> 01:25:48,080

the next day and go in to walk

2148

01:25:51,350 --> 01:25:49,280

how do you make yourself breakfast and

2149

01:25:52,790 --> 01:25:51,360

just go back to normal when you've had

2150

01:25:54,629 --> 01:25:52,800

some extensive crisis where someone's

2151
01:25:55,430 --> 01:25:54,639
just come by and said that's not how

2152
01:25:58,470 --> 01:25:55,440
time works

2153
01:26:00,310 --> 01:25:58,480
can prove it they say oh my god he's

2154
01:26:01,990 --> 01:26:00,320
right that is not how time works

2155
01:26:03,910 --> 01:26:02,000
this is not how space works this

2156
01:26:05,510 --> 01:26:03,920
universe i thought i lived on which is

2157
01:26:07,030 --> 01:26:05,520
my little town that people tell me is

2158
01:26:08,629 --> 01:26:07,040
even bigger you know none of us remember

2159
01:26:10,790 --> 01:26:08,639
the existential shock of realizing the

2160
01:26:12,709 --> 01:26:10,800
planet we live on is a big sphere

2161
01:26:14,390 --> 01:26:12,719
but you didn't know that when you're two

2162
01:26:15,510 --> 01:26:14,400
you know you you never really thought it

2163
01:26:17,350 --> 01:26:15,520

was flat maybe but

2164

01:26:20,229 --> 01:26:17,360

your universe was your backyard your

2165

01:26:21,910 --> 01:26:20,239

house now it's seven billion people

2166

01:26:24,229 --> 01:26:21,920

and then someone comes by and tells you

2167

01:26:26,229 --> 01:26:24,239

that's just a tiny pale little blue dot

2168

01:26:28,149 --> 01:26:26,239

in a galaxy that is an insignificant

2169

01:26:29,910 --> 01:26:28,159

fraction of the hole

2170

01:26:32,229 --> 01:26:29,920

um but you start getting to work the

2171

01:26:34,070 --> 01:26:32,239

next day and uh you still got

2172

01:26:35,669 --> 01:26:34,080

go turn the car in the morning take a

2173

01:26:37,270 --> 01:26:35,679

shower driving a walk

2174

01:26:39,030 --> 01:26:37,280

how do you do that i don't know how do

2175

01:26:43,110 --> 01:26:39,040

any of us do it it's

2176
01:26:45,510 --> 01:26:43,120
a balancing act but it's fun right now

2177
01:26:47,750 --> 01:26:45,520
okay when we come back we'll we'll

2178
01:26:48,870 --> 01:26:47,760
change subjects but i wanted to ask you

2179
01:26:52,709 --> 01:26:48,880
this

2180
01:26:56,629 --> 01:26:52,719
why isn't it possible

2181
01:27:00,870 --> 01:26:56,639
to have position and velocity at the

2182
01:27:03,990 --> 01:27:02,550
those two are complementary things you

2183
01:27:05,270 --> 01:27:04,000
can know pretty accurately but it's not

2184
01:27:06,629 --> 01:27:05,280
that you can't know them is they can

2185
01:27:07,990 --> 01:27:06,639
only know them with a certain amount of

2186
01:27:09,510 --> 01:27:08,000
accuracy and the more accurate you want

2187
01:27:10,470 --> 01:27:09,520
to be with the one the more uncertain

2188
01:27:12,310 --> 01:27:10,480

the other is

2189

01:27:13,990 --> 01:27:12,320

if you knew perfectly accurately the way

2190

01:27:15,430 --> 01:27:14,000

it was you would it would have an

2191

01:27:16,070 --> 01:27:15,440

infinite velocity be somewhere else's

2192

01:27:17,990 --> 01:27:16,080

wall

2193

01:27:19,910 --> 01:27:18,000

but they're linked together you can only

2194

01:27:21,350 --> 01:27:19,920

be as certain about the one as you are

2195

01:27:23,110 --> 01:27:21,360

uncertain about the other but you can

2196

01:27:26,629 --> 01:27:23,120

still be pretty certain it's a very

2197

01:27:29,590 --> 01:27:26,639

tiny amount it's about 10 negative 33

2198

01:27:30,310 --> 01:27:29,600

or 35 kilogram meters per second very

2199

01:27:33,669 --> 01:27:30,320

tiny

2200

01:27:36,790 --> 01:27:33,679

and and that and it won't work in in in

2201

01:27:38,470 --> 01:27:36,800

an equation right you can't have

2202

01:27:40,629 --> 01:27:38,480

position

2203

01:27:41,669 --> 01:27:40,639

with a particle and velocity at the same

2204

01:27:43,510 --> 01:27:41,679

time

2205

01:27:45,030 --> 01:27:43,520

oh no you you can have the equation for

2206

01:27:46,390 --> 01:27:45,040

it actually works out quite well and and

2207

01:27:47,350 --> 01:27:46,400

we can predict that when science it's

2208

01:27:49,189 --> 01:27:47,360

basically why

2209

01:27:51,430 --> 01:27:49,199

everything at the atomic scale works the

2210

01:27:53,590 --> 01:27:51,440

way it does right why it is that we have

2211

01:27:56,229 --> 01:27:53,600

no idea but the math what works and

2212

01:27:58,950 --> 01:27:56,239

and it works out on experimentation too

2213

01:28:01,669 --> 01:27:58,960

no idea why it does it though

2214

01:28:03,669 --> 01:28:01,679

i remember uh i studied this so much and

2215

01:28:04,709 --> 01:28:03,679

i don't understand the math and i'd uh

2216

01:28:11,669 --> 01:28:04,719

i've

2217

01:28:15,189 --> 01:28:11,679

but it was really funny um i heard

2218

01:28:16,870 --> 01:28:15,199

i i forget the physicist but he takes a

2219

01:28:17,990 --> 01:28:16,880

question from the audience this was a

2220

01:28:20,820 --> 01:28:18,000

couple of years ago

2221

01:28:22,070 --> 01:28:20,830

you know at the end of a lecture and

2222

01:28:25,189 --> 01:28:22,080

[Music]

2223

01:28:28,550 --> 01:28:25,199

he says i'm learning

2224

01:28:31,110 --> 01:28:28,560

physics from your book right

2225

01:28:31,910 --> 01:28:31,120

and he says no you're not that's

2226

01:28:34,629 --> 01:28:31,920

impossible

2227

01:28:37,030 --> 01:28:34,639

and he goes no no no i guess no no

2228

01:28:38,709 --> 01:28:37,040

there's no math in my book

2229

01:28:40,709 --> 01:28:38,719

you're reading my interpretation of

2230

01:28:43,430 --> 01:28:40,719

physics right

2231

01:28:44,070 --> 01:28:43,440

and and that's the position i'm in i

2232

01:28:45,669 --> 01:28:44,080

unders i

2233

01:28:47,270 --> 01:28:45,679

i listen to the concepts and i'm

2234

01:28:49,990 --> 01:28:47,280

fascinated with it

2235

01:28:51,350 --> 01:28:50,000

but i'm not a physicist right and i

2236

01:28:53,030 --> 01:28:51,360

never remember as a reality as you gotta

2237

01:28:54,629 --> 01:28:53,040

be able to do the math to really get to

2238

01:28:56,390 --> 01:28:54,639

enjoy it to four degrees we can talk

2239

01:28:57,750 --> 01:28:56,400

about the philosophy of it and that

2240

01:28:59,110 --> 01:28:57,760

doesn't necessarily require all the

2241

01:29:00,470 --> 01:28:59,120

equations but to really get to mess

2242

01:29:01,990 --> 01:29:00,480

around with it you do have to have that

2243

01:29:03,750 --> 01:29:02,000

math background which

2244

01:29:06,470 --> 01:29:03,760

sadly a lot of folks is not their cup of

2245

01:29:07,189 --> 01:29:06,480

tea but i barely made it out of algebra

2246

01:29:09,189 --> 01:29:07,199

2.

2247

01:29:10,310 --> 01:29:09,199

let's take our break right here our

2248

01:29:12,470 --> 01:29:10,320

guest tonight

2249

01:29:13,830 --> 01:29:12,480

isaac arthur i am your host jimmy church

2250

01:29:15,510 --> 01:29:13,840

this is fade to black

2251
01:29:16,870 --> 01:29:15,520
we got a lot more to talk about when we

2252
01:29:18,390 --> 01:29:16,880
come back we're going to talk about the

2253
01:29:20,070 --> 01:29:18,400
expansion of the universe

2254
01:29:21,590 --> 01:29:20,080
and it's not going to be what you think

2255
01:29:22,229 --> 01:29:21,600
this is fade to black i'm real timmy

2256
01:29:24,149 --> 01:29:22,239
church

2257
01:29:42,229 --> 01:29:24,159
more with isaac arthur after this short

2258
01:29:48,470 --> 01:29:45,350
way out here we listen to jimmy church

2259
01:29:50,310 --> 01:29:48,480
you're listening to fade to black

2260
01:29:52,390 --> 01:29:50,320
always on the edge of the hottest

2261
01:30:10,310 --> 01:29:52,400
alternative talk jimmy church

2262
01:30:14,390 --> 01:30:12,390
do you want to be an official fate or

2263
01:30:16,470 --> 01:30:14,400

not of course you do

2264

01:30:17,990 --> 01:30:16,480

this is jimmy churchill fade to black

2265

01:30:21,510 --> 01:30:18,000

just go to our membership

2266

01:30:23,510 --> 01:30:21,520

section at jimmy jimmychurchradio.com

2267

01:30:25,350 --> 01:30:23,520

fader knots when you think about the

2268

01:30:27,189 --> 01:30:25,360

future of our country and where we're

2269

01:30:28,149 --> 01:30:27,199

headed do you wonder about the food

2270

01:30:32,310 --> 01:30:28,159

supply

2271

01:30:34,390 --> 01:30:32,320

chain could be disastrous

2272

01:30:36,709 --> 01:30:34,400

and they usually occur with little

2273

01:30:37,750 --> 01:30:36,719

warning that's why the smartest thing

2274

01:30:40,870 --> 01:30:37,760

you can do today

2275

01:30:43,270 --> 01:30:40,880

is to stockpile emergency food water

2276

01:30:43,910 --> 01:30:43,280
and other essentials i personally

2277

01:30:46,550 --> 01:30:43,920
recommend

2278

01:30:49,030 --> 01:30:46,560
my patriot supply they're the nation's

2279

01:30:51,270 --> 01:30:49,040
largest emergency preparedness company

2280

01:30:52,390 --> 01:30:51,280
serving millions of customers for more

2281

01:30:54,790 --> 01:30:52,400
than a decade

2282

01:30:57,430 --> 01:30:54,800
in fact they're the only source my

2283

01:31:00,149 --> 01:30:57,440
family trusts for our preparedness plan

2284

01:31:02,629 --> 01:31:00,159
you should too right now save twenty

2285

01:31:04,550 --> 01:31:02,639
percent off of full four week supply of

2286

01:31:08,149 --> 01:31:04,560
delicious meals that provide 2

2287

01:31:11,110 --> 01:31:08,159
000 calories a day saving 20 helps too

2288

01:31:14,070 --> 01:31:11,120

doesn't it especially now so go to

2289

01:31:17,350 --> 01:31:14,080

prepare with jimmy.com and get ready

2290

01:31:18,709 --> 01:31:17,360

that's prepare with jimmy.com there's no

2291

01:31:21,990 --> 01:31:18,719

time to lose

2292

01:31:28,229 --> 01:31:25,950

so you love talk radio then you'll love

2293

01:31:30,790 --> 01:31:28,239

talkstreamlive.com talk stream live

2294

01:31:32,070 --> 01:31:30,800

is always on 24 7 with the best

2295

01:31:34,149 --> 01:31:32,080

streaming talk shows

2296

01:31:35,669 --> 01:31:34,159

find your favorite talkers and discover

2297

01:31:38,310 --> 01:31:35,679

some new ones it's free

2298

01:31:40,070 --> 01:31:38,320

readily available online or on mobile

2299

01:31:42,070 --> 01:31:40,080

with any smartphone or tablet

2300

01:31:44,790 --> 01:31:42,080

finding your favorite talk shows all in

2301
01:31:54,630 --> 01:31:44,800
one place has gotten a whole lot easier

2302
01:31:58,360 --> 01:31:57,110
[Music]

2303
01:32:01,430 --> 01:31:58,370
does the downl

2304
01:32:01,430 --> 01:32:01,440
[Music]

2305
01:32:01,440 --> 01:32:06,470
kg r a radio.com

2306
01:32:10,830 --> 01:32:08,550
you are listening to fate to black with

2307
01:32:13,350 --> 01:32:10,840
jimmy church on the game changing

2308
01:32:15,830 --> 01:32:13,360
network

2309
01:32:16,950 --> 01:32:15,840
hi i'm rhys evans you're listening to

2310
01:32:20,070 --> 01:32:16,960
jimmy church

2311
01:32:21,350 --> 01:32:20,080
this is revolution the revolution will

2312
01:32:24,870 --> 01:32:21,360
not be televised

2313
01:32:27,790 --> 01:32:24,880

the revolution is on radio

2314

01:32:52,830 --> 01:32:27,800

ciao

2315

01:32:52,840 --> 01:32:57,880

so

2316

01:33:07,590 --> 01:33:03,490

[Music]

2317

01:33:10,790 --> 01:33:08,950

welcome back fade to black i'm yours

2318

01:33:11,510 --> 01:33:10,800

jimmy church before we get back to isaac

2319

01:33:13,910 --> 01:33:11,520

arthur

2320

01:33:17,430 --> 01:33:13,920

our guest tonight talk to you about

2321

01:33:19,510 --> 01:33:17,440

virtual shield vpn because right now

2322

01:33:22,070 --> 01:33:19,520

there are suggestions that our credit

2323

01:33:24,790 --> 01:33:22,080

scores might be based on our internet

2324

01:33:26,229 --> 01:33:24,800

history in the near future the same way

2325

01:33:29,590 --> 01:33:26,239

banks use data like

2326

01:33:31,510 --> 01:33:29,600

income to judge credit eligibility now

2327

01:33:33,350 --> 01:33:31,520

is how websites could use the internet

2328

01:33:35,189 --> 01:33:33,360

search history in

2329

01:33:37,590 --> 01:33:35,199

in the future researchers studying the

2330

01:33:39,350 --> 01:33:37,600

relationship between finance and tech

2331

01:33:41,510 --> 01:33:39,360

found that data from your browsing your

2332

01:33:44,870 --> 01:33:41,520

search history and your purchase history

2333

01:33:47,030 --> 01:33:44,880

could be used to decide your credit

2334

01:33:48,310 --> 01:33:47,040

in the future you want to prevent this

2335

01:33:51,430 --> 01:33:48,320

from happening to you

2336

01:33:52,790 --> 01:33:51,440

you've got to use the very best vpn so

2337

01:33:54,709 --> 01:33:52,800

you can keep your search history

2338

01:33:58,470 --> 01:33:54,719

separate from your personal data

2339

01:33:59,990 --> 01:33:58,480

i highly recommend virtual shield vpn

2340

01:34:02,390 --> 01:34:00,000

you can see all the computers that run

2341

01:34:04,550 --> 01:34:02,400

this show each night in this studio

2342

01:34:05,990 --> 01:34:04,560

there are six there are two more in the

2343

01:34:09,590 --> 01:34:06,000

studio down the hall

2344

01:34:12,550 --> 01:34:09,600

all use virtual shield vpn

2345

01:34:15,189 --> 01:34:12,560

simple to do go to virtual shield

2346

01:34:17,430 --> 01:34:15,199

virtual shield dot com fade to black

2347

01:34:18,470 --> 01:34:17,440

virtual shield dot com forward slash

2348

01:34:19,709 --> 01:34:18,480

fade to black

2349

01:34:21,590 --> 01:34:19,719

click on the link go over to

2350

01:34:22,950 --> 01:34:21,600

jimmychurchradio.com we have banners and

2351

01:34:25,750 --> 01:34:22,960

advertising over there

2352

01:34:27,910 --> 01:34:25,760

and you can also click on the link in

2353

01:34:31,510 --> 01:34:27,920

the video description box below

2354

01:34:34,870 --> 01:34:31,520

you will get virtual shield vpn for 50

2355

01:34:36,229 --> 01:34:34,880

off today virtual shield all right back

2356

01:34:38,470 --> 01:34:36,239

to isaac arthur isaac

2357

01:34:40,950 --> 01:34:38,480

okay now let's change gears i want to

2358

01:34:44,709 --> 01:34:40,960

talk about

2359

01:34:47,830 --> 01:34:44,719

the universe and the reason why

2360

01:34:50,950 --> 01:34:47,840

the data coming in uh

2361

01:34:52,950 --> 01:34:50,960

today uh about our knowledge of the

2362

01:34:55,910 --> 01:34:52,960

universe and our galaxy

2363

01:34:57,669 --> 01:34:55,920

the numbers are changing um they're

2364

01:34:58,870 --> 01:34:57,679

going up and up and up it doesn't matter

2365

01:35:00,149 --> 01:34:58,880

if we're talking about the total of

2366

01:35:03,350 --> 01:35:00,159

stars in our galaxy

2367

01:35:05,030 --> 01:35:03,360

or the total galaxies in in the known

2368

01:35:08,310 --> 01:35:05,040

universe the observable

2369

01:35:11,189 --> 01:35:08,320

universe or beyond um but we

2370

01:35:13,109 --> 01:35:11,199

do know this and the numbers are are

2371

01:35:16,870 --> 01:35:13,119

getting out of control

2372

01:35:20,070 --> 01:35:16,880

but now the concept

2373

01:35:23,189 --> 01:35:20,080

of the speed of light is

2374

01:35:26,629 --> 01:35:23,199

is getting strange because

2375

01:35:29,830 --> 01:35:26,639

apparently at the outer

2376

01:35:32,790 --> 01:35:29,840

edges of our universe those galaxies

2377

01:35:33,669 --> 01:35:32,800

that part of the universe is expanding

2378

01:35:36,709 --> 01:35:33,679

faster

2379

01:35:40,070 --> 01:35:36,719

than the speed of light now

2380

01:35:43,030 --> 01:35:40,080

let's let's start right there

2381

01:35:45,189 --> 01:35:43,040

is is that possible are you part of this

2382

01:35:47,750 --> 01:35:45,199

group

2383

01:35:49,830 --> 01:35:47,760

we basically define the edge of the

2384

01:35:51,590 --> 01:35:49,840

universe of the observable universe

2385

01:35:53,430 --> 01:35:51,600

specifically the absorbable universe as

2386

01:35:54,149 --> 01:35:53,440

the place where the galaxies at the edge

2387

01:35:55,510 --> 01:35:54,159

of it

2388

01:35:57,750 --> 01:35:55,520

are moving at the speed of light away

2389

01:35:59,350 --> 01:35:57,760

from us the ones out past that are

2390

01:36:00,709 --> 01:35:59,360

strictly hypothetical but we assume they

2391

01:36:02,709 --> 01:36:00,719

exist and they are moving

2392

01:36:03,990 --> 01:36:02,719

away faster on the speed of light and

2393

01:36:06,470 --> 01:36:04,000

most of the ones we actually see right

2394

01:36:07,590 --> 01:36:06,480

now most of the universe that we can see

2395

01:36:09,669 --> 01:36:07,600

since what they'll get from was much

2396

01:36:11,270 --> 01:36:09,679

older has already gone over that thing

2397

01:36:12,470 --> 01:36:11,280

based on our calculations

2398

01:36:13,669 --> 01:36:12,480

it's a funny thing as we always say

2399

01:36:14,550 --> 01:36:13,679

nothing can move faster than speed of

2400

01:36:15,910 --> 01:36:14,560

light

2401

01:36:17,590 --> 01:36:15,920

except the vast majority of the

2402

01:36:19,590 --> 01:36:17,600

absorbable universe is moving away from

2403

01:36:23,430 --> 01:36:19,600

us faster than the speed of light

2404

01:36:24,550 --> 01:36:23,440

and now would would einstein agree with

2405

01:36:28,310 --> 01:36:24,560

this

2406

01:36:29,350 --> 01:36:28,320

let's start with einstein if he was

2407

01:36:32,070 --> 01:36:29,360

around

2408

01:36:33,350 --> 01:36:32,080

what what would that discussion be like

2409

01:36:34,629 --> 01:36:33,360

well we'd already kind of come up with

2410

01:36:35,189 --> 01:36:34,639

the idea that's probably what was

2411

01:36:37,430 --> 01:36:35,199

happening

2412

01:36:38,950 --> 01:36:37,440

while he was still around um and that's

2413

01:36:41,430 --> 01:36:38,960

that's basically notion of the hubble

2414

01:36:43,109 --> 01:36:41,440

expansion

2415

01:36:44,629 --> 01:36:43,119

from which we predicted the big bang but

2416

01:36:45,350 --> 01:36:44,639

it was a little bit more tenuous until

2417

01:36:48,390 --> 01:36:45,360

then

2418

01:36:49,510 --> 01:36:48,400

um the basic notion is that everywhere

2419

01:36:51,990 --> 01:36:49,520

in the universe

2420

01:36:53,910 --> 01:36:52,000

little particles of space time are

2421

01:36:55,430 --> 01:36:53,920

popping into existence everywhere inside

2422

01:36:57,750 --> 01:36:55,440

you right now probably

2423

01:36:58,790 --> 01:36:57,760

very tiny plank-sized ones which again a

2424

01:37:01,830 --> 01:36:58,800

planck scale

2425

01:37:04,149 --> 01:37:01,840

length or volume is to an atom what an

2426

01:37:06,070 --> 01:37:04,159

atom is to a galaxy right there they are

2427

01:37:07,990 --> 01:37:06,080

very tiny but they popping up everywhere

2428

01:37:10,709 --> 01:37:08,000

in the universe simultaneously

2429

01:37:12,310 --> 01:37:10,719

in little bits and random locations and

2430

01:37:13,830 --> 01:37:12,320

if you go farther away from somebody

2431

01:37:15,669 --> 01:37:13,840

there's going to be a good deal more of

2432

01:37:17,189 --> 01:37:15,679

them popping up between you and it

2433

01:37:18,950 --> 01:37:17,199

at a certain point the number will pop

2434

01:37:20,950 --> 01:37:18,960

you up in a given second between you

2435

01:37:23,109 --> 01:37:20,960

and that object if you're far enough

2436

01:37:23,910 --> 01:37:23,119

away is going to start getting to the

2437

01:37:26,149 --> 01:37:23,920

point where

2438

01:37:27,430 --> 01:37:26,159

it's creating space between you at a

2439

01:37:27,910 --> 01:37:27,440

pretty decent fraction of the speed of

2440

01:37:29,510 --> 01:37:27,920

light

2441

01:37:31,350 --> 01:37:29,520

you go double that distance it's double

2442

01:37:33,510 --> 01:37:31,360

that speed and at some point it

2443

01:37:35,510 --> 01:37:33,520

is higher than the speed of light and

2444

01:37:37,270 --> 01:37:35,520

this doesn't actually violate the whole

2445

01:37:38,709 --> 01:37:37,280

speed of light issue since

2446

01:37:40,310 --> 01:37:38,719

the speed of light is kind of a misnomer

2447

01:37:41,430 --> 01:37:40,320

anyway it's about how fast can i move

2448

01:37:44,149 --> 01:37:41,440

information between

2449

01:37:45,910 --> 01:37:44,159

two points and we say that information

2450

01:37:47,430 --> 01:37:45,920

cannot be moved between anything

2451
01:37:49,030 --> 01:37:47,440
faster than the speed of light so it

2452
01:37:50,310 --> 01:37:49,040
doesn't bother us that space depending

2453
01:37:51,189 --> 01:37:50,320
between these things fasten the speed of

2454
01:37:53,350 --> 01:37:51,199
light

2455
01:37:54,950 --> 01:37:53,360
um but that's been one of those accepted

2456
01:37:58,790 --> 01:37:54,960
ideas for a long while now

2457
01:37:59,189 --> 01:37:58,800
now if we take i want the audience to

2458
01:38:02,390 --> 01:37:59,199
just

2459
01:38:05,910 --> 01:38:02,400
imagine this if you blow up a balloon

2460
01:38:09,030 --> 01:38:05,920
and you're watching the balloon expand

2461
01:38:11,590 --> 01:38:09,040
well if it was full of particles

2462
01:38:12,070 --> 01:38:11,600
and you said that's what the universe is

2463
01:38:15,270 --> 01:38:12,080

doing

2464

01:38:19,270 --> 01:38:15,280

and the expansion is happening and

2465

01:38:24,149 --> 01:38:19,280

it can be measured is the speed of light

2466

01:38:25,990 --> 01:38:24,159

if i am next to okay we pick a galaxy

2467

01:38:27,430 --> 01:38:26,000

we know that it's traveling at the speed

2468

01:38:30,149 --> 01:38:27,440

of light uh

2469

01:38:31,350 --> 01:38:30,159

in the expansion of the universe but if

2470

01:38:34,629 --> 01:38:31,360

you and i position

2471

01:38:38,310 --> 01:38:34,639

ourselves out near that galaxy

2472

01:38:41,030 --> 01:38:38,320

we are now at its constant

2473

01:38:41,910 --> 01:38:41,040

yep right so it's not moving at the

2474

01:38:45,350 --> 01:38:41,920

speed of light

2475

01:38:47,109 --> 01:38:45,360

relative to our position in space

2476
01:38:49,510 --> 01:38:47,119
yeah it's moving at the speed of light

2477
01:38:51,109 --> 01:38:49,520
relative to us

2478
01:38:52,550 --> 01:38:51,119
in the sense that it is moving away from

2479
01:38:53,750 --> 01:38:52,560
us faster than the speed of light or at the

2480
01:38:55,030 --> 01:38:53,760
speed of light if we were to transport

2481
01:38:56,950 --> 01:38:55,040
ourselves to where it's at

2482
01:38:58,470 --> 01:38:56,960
it would see us doing the same thing if

2483
01:39:00,149 --> 01:38:58,480
you put two little dots on that balloon

2484
01:39:01,109 --> 01:39:00,159
and that balloon's expanding

2485
01:39:02,950 --> 01:39:01,119
that's kind of the motion that's

2486
01:39:04,790 --> 01:39:02,960
involved there the balloons expanding

2487
01:39:06,310 --> 01:39:04,800
one could imagine that an ant walking

2488
01:39:08,709 --> 01:39:06,320

between two dots on that balloon

2489

01:39:10,149 --> 01:39:08,719

could go back and forth between them but

2490

01:39:11,750 --> 01:39:10,159

at a certain point the expansion that

2491

01:39:13,109 --> 01:39:11,760

balloon is going fast and the ant can

2492

01:39:14,070 --> 01:39:13,119

walk that distance between those two

2493

01:39:16,149 --> 01:39:14,080

dots

2494

01:39:17,590 --> 01:39:16,159

substitute in a particle of light for

2495

01:39:18,229 --> 01:39:17,600

the ants and that's basically the idea

2496

01:39:19,669 --> 01:39:18,239

there

2497

01:39:21,750 --> 01:39:19,679

nothing's really moving but at the same

2498

01:39:23,910 --> 01:39:21,760

time what is motion anyway

2499

01:39:26,390 --> 01:39:23,920

so it is kind of hard to say that that

2500

01:39:28,629 --> 01:39:26,400

is the sole exception

2501

01:39:30,229 --> 01:39:28,639

uh and again everything in the universe

2502

01:39:31,910 --> 01:39:30,239

is moving away from each other

2503

01:39:33,750 --> 01:39:31,920

most of it is moving away fast and speed

2504

01:39:34,790 --> 01:39:33,760

of light so it does make it harder

2505

01:39:36,149 --> 01:39:34,800

harder to say that nothing's really

2506

01:39:37,669 --> 01:39:36,159

moving away from anything else fast from

2507

01:39:40,229 --> 01:39:37,679

speed of light when almost everything is

2508

01:39:43,350 --> 01:39:40,239

actually doing that but at the same time

2509

01:39:45,669 --> 01:39:43,360

right at the same time yes so so if you

2510

01:39:46,950 --> 01:39:45,679

and i are positioned next to that galaxy

2511

01:39:49,430 --> 01:39:46,960

that we know is

2512

01:39:50,390 --> 01:39:49,440

moving away from us at the speed of

2513

01:39:54,070 --> 01:39:50,400

light

2514

01:39:56,390 --> 01:39:54,080

we are now in that position in

2515

01:39:57,910 --> 01:39:56,400

space and we become part of the

2516

01:40:00,870 --> 01:39:57,920

expansion

2517

01:40:02,709 --> 01:40:00,880

right so we're just we're not still

2518

01:40:06,229 --> 01:40:02,719

right space isn't moving past

2519

01:40:08,070 --> 01:40:06,239

us we are now in that part of space so

2520

01:40:11,189 --> 01:40:08,080

now we are

2521

01:40:12,470 --> 01:40:11,199

in the expansion together we are

2522

01:40:14,229 --> 01:40:12,480

all expanding away from each other

2523

01:40:15,030 --> 01:40:14,239

simultaneously again what it comes down

2524

01:40:16,629 --> 01:40:15,040

to is

2525

01:40:18,070 --> 01:40:16,639

little bits of new space are popping up

2526

01:40:20,470 --> 01:40:18,080

everywhere inside you

2527

01:40:22,390 --> 01:40:20,480

inside the planet but it's just so tiny

2528

01:40:23,750 --> 01:40:22,400

relatively speaking that we don't notice

2529

01:40:24,950 --> 01:40:23,760

ourselves being pushed apart by it you

2530

01:40:25,750 --> 01:40:24,960

know we're being pulled back together by

2531

01:40:27,270 --> 01:40:25,760

forces

2532

01:40:28,950 --> 01:40:27,280

we heat up to the galactic scale it

2533

01:40:31,270 --> 01:40:28,960

starts getting kind of noticeable

2534

01:40:32,550 --> 01:40:31,280

most galaxies near us are being held to

2535

01:40:35,109 --> 01:40:32,560

us by gravity

2536

01:40:37,270 --> 01:40:35,119

but barely uh you get further away then

2537

01:40:40,149 --> 01:40:37,280

about 10 million light years

2538

01:40:40,709 --> 01:40:40,159

and that influence of expansion starts

2539

01:40:42,229 --> 01:40:40,719

to

2540

01:40:43,830 --> 01:40:42,239

new spaces pop you up faster than

2541

01:40:44,310 --> 01:40:43,840

gravity can pull those objects together

2542

01:40:47,030 --> 01:40:44,320

well

2543

01:40:48,629 --> 01:40:47,040

gravity is getting thinned out too right

2544

01:40:49,910 --> 01:40:48,639

that is has to run that distance to you

2545

01:40:50,470 --> 01:40:49,920

gravity travels the speed of light

2546

01:40:54,310 --> 01:40:50,480

that's right

2547

01:40:58,149 --> 01:40:54,320

okay so if

2548

01:40:59,750 --> 01:40:58,159

we are you and i are out at that galaxy

2549

01:41:01,510 --> 01:40:59,760

moving away at the speed of light right

2550

01:41:04,709 --> 01:41:01,520

you and i are there

2551
01:41:08,709 --> 01:41:04,719
are we observed from

2552
01:41:09,590 --> 01:41:08,719
earth as also traveling at the speed of

2553
01:41:12,550 --> 01:41:09,600
light

2554
01:41:14,149 --> 01:41:12,560
are we now part of that expansion if we

2555
01:41:16,310 --> 01:41:14,159
were there yes yeah right

2556
01:41:17,270 --> 01:41:16,320
okay but i should note that we would see

2557
01:41:18,629 --> 01:41:17,280
ourselves there because we're moving

2558
01:41:18,950 --> 01:41:18,639
away the speed of light that's just the

2559
01:41:21,629 --> 01:41:18,960
little

2560
01:41:22,790 --> 01:41:21,639
edge of the universe okay right we're at

2561
01:41:25,270 --> 01:41:22,800
99.999

2562
01:41:26,950 --> 01:41:25,280
let's okay so anyway i love this

2563
01:41:29,830 --> 01:41:26,960

conversation

2564

01:41:30,790 --> 01:41:29,840

if we were able to this is your next uh

2565

01:41:32,390 --> 01:41:30,800

episode of

2566

01:41:33,830 --> 01:41:32,400

future science by the way i'm just

2567

01:41:35,109 --> 01:41:33,840

laying it out in front of you you can

2568

01:41:38,870 --> 01:41:35,119

take notes later

2569

01:41:42,709 --> 01:41:38,880

but it's a gift okay so now what if

2570

01:41:45,430 --> 01:41:42,719

we were able to fold space

2571

01:41:47,590 --> 01:41:45,440

not talking about wormholes not talking

2572

01:41:50,550 --> 01:41:47,600

about any other type of travel

2573

01:41:51,910 --> 01:41:50,560

i'm not talking about physical speed of

2574

01:41:53,109 --> 01:41:51,920

light of fat no i'm talking about

2575

01:41:56,550 --> 01:41:53,119

folding space

2576
01:41:57,030 --> 01:41:56,560
so now you and i are moving away from

2577
01:41:59,350 --> 01:41:57,040
earth

2578
01:42:00,229 --> 01:41:59,360
we are observing us traveling at the

2579
01:42:03,350 --> 01:42:00,239
speed of light

2580
01:42:06,470 --> 01:42:03,360
we have that velocity

2581
01:42:10,149 --> 01:42:06,480
relative to our position at earth

2582
01:42:13,669 --> 01:42:10,159
okay and we folded that space

2583
01:42:17,830 --> 01:42:13,679
back and we step

2584
01:42:21,189 --> 01:42:17,840
out are we at the velocity

2585
01:42:24,310 --> 01:42:21,199
that we were at in the previous position

2586
01:42:25,189 --> 01:42:24,320
do we do we pop out at earth at the

2587
01:42:28,550 --> 01:42:25,199
speed of light

2588
01:42:31,510 --> 01:42:28,560

and disappear probably

2589

01:42:33,109 --> 01:42:31,520

um if you because you don't really have

2590

01:42:34,470 --> 01:42:33,119

a velocity from that if you are selling

2591

01:42:35,430 --> 01:42:34,480

appeal here

2592

01:42:36,950 --> 01:42:35,440

and keep in mind there's a lot of

2593

01:42:38,470 --> 01:42:36,960

hypothetical on this because we don't

2594

01:42:40,790 --> 01:42:38,480

have a means for doing this

2595

01:42:42,310 --> 01:42:40,800

but if you suddenly appeal here you

2596

01:42:43,510 --> 01:42:42,320

should have no velocity from that

2597

01:42:45,189 --> 01:42:43,520

expansion anymore

2598

01:42:46,629 --> 01:42:45,199

because that that velocity is being

2599

01:42:47,830 --> 01:42:46,639

caused by the space between you

2600

01:42:49,910 --> 01:42:47,840

increasing

2601

01:42:51,669 --> 01:42:49,920

um it's the kind of like with wormholes

2602

01:42:53,189 --> 01:42:51,679

people will suggest if i took a wormhole

2603

01:42:54,629 --> 01:42:53,199

and i put one bottom end

2604

01:42:56,070 --> 01:42:54,639

you know up in the air and the other end

2605

01:42:57,590 --> 01:42:56,080

down the ground i dropped a ball between

2606

01:42:58,629 --> 01:42:57,600

them right so it fell through the hole

2607

01:42:59,189 --> 01:42:58,639

on the bottom and popped back on the

2608

01:43:00,550 --> 01:42:59,199

other one

2609

01:43:01,750 --> 01:43:00,560

right shouldn't that create a perpetual

2610

01:43:02,950 --> 01:43:01,760

motion machine that's right and the

2611

01:43:04,629 --> 01:43:02,960

answer was no it would actually come

2612

01:43:06,310 --> 01:43:04,639

back through on the math it would just

2613

01:43:08,390 --> 01:43:06,320

fall down there and come right back up

2614

01:43:12,070 --> 01:43:08,400

losing your speed on the way down

2615

01:43:15,109 --> 01:43:12,080

because that's right okay

2616

01:43:18,790 --> 01:43:15,119

but if that is the case where we

2617

01:43:20,790 --> 01:43:18,800

wouldn't possess the velocity

2618

01:43:22,390 --> 01:43:20,800

from deep space at the expansion of the

2619

01:43:23,590 --> 01:43:22,400

speed of light right we come back here

2620

01:43:26,070 --> 01:43:23,600

we fold space

2621

01:43:28,950 --> 01:43:26,080

we're not carrying that velocity anymore

2622

01:43:32,070 --> 01:43:28,960

we're back into space time here on earth

2623

01:43:35,590 --> 01:43:32,080

right yep but what if it is so if

2624

01:43:38,229 --> 01:43:35,600

that is the case what happens if we fold

2625

01:43:41,109 --> 01:43:38,239

space in the opposite direction

2626
01:43:42,629 --> 01:43:41,119
now isaac and jimmy are here on earth

2627
01:43:46,390 --> 01:43:42,639
with our velocity

2628
01:43:48,310 --> 01:43:46,400
in this position we fold space to

2629
01:43:49,430 --> 01:43:48,320
the distant galaxy that's traveling at

2630
01:43:52,229 --> 01:43:49,440
the speed of light

2631
01:43:53,510 --> 01:43:52,239
and we step out if we now have the

2632
01:43:58,470 --> 01:43:53,520
velocity

2633
01:44:01,830 --> 01:43:58,480
galaxy now

2634
01:44:04,629 --> 01:44:01,840
shoot off from us at the speed of light

2635
01:44:06,310 --> 01:44:04,639
and we are is do you see what i'm saying

2636
01:44:07,830 --> 01:44:06,320
we should appear and step out of it and

2637
01:44:09,270 --> 01:44:07,840
have no motion

2638
01:44:11,510 --> 01:44:09,280

except for whatever relative emotion

2639

01:44:13,910 --> 01:44:11,520

there was locally so how could we ever

2640

01:44:16,390 --> 01:44:13,920

catch up to the edge of the universe

2641

01:44:17,270 --> 01:44:16,400

you can't you can't can you it's gone

2642

01:44:19,830 --> 01:44:17,280

it's gone forever

2643

01:44:20,629 --> 01:44:19,840

and it no matter what we do see i'm

2644

01:44:23,910 --> 01:44:20,639

trying to

2645

01:44:26,149 --> 01:44:23,920

cheat science here right how do we get

2646

01:44:27,669 --> 01:44:26,159

to the edge of the observable everything

2647

01:44:30,709 --> 01:44:27,679

that's traveling at the speed of light

2648

01:44:32,470 --> 01:44:30,719

so we can count some galaxies right

2649

01:44:34,149 --> 01:44:32,480

as best as we can well we we lose

2650

01:44:36,229 --> 01:44:34,159

galaxies every day probably

2651

01:44:37,189 --> 01:44:36,239

i i mean probably about a galaxy a day

2652

01:44:38,390 --> 01:44:37,199

if never bits off

2653

01:44:40,390 --> 01:44:38,400

that's how many galaxies are getting

2654

01:44:43,510 --> 01:44:40,400

hammered you know so

2655

01:44:47,350 --> 01:44:43,520

we will the universe and

2656

01:44:49,910 --> 01:44:47,360

especially if it's ftl double ftl

2657

01:44:51,590 --> 01:44:49,920

if you double the distance right yep

2658

01:44:54,149 --> 01:44:51,600

there is no way to

2659

01:44:55,270 --> 01:44:54,159

ever catch up because when you get there

2660

01:44:57,350 --> 01:44:55,280

it's gone

2661

01:44:58,629 --> 01:44:57,360

yeah with one exception is if you could

2662

01:45:00,870 --> 01:44:58,639

make one of the uh

2663

01:45:02,629 --> 01:45:00,880

the hypothetical engines like an Alcubierre

2664

01:45:03,510 --> 01:45:02,639

warp drive that actually contracts space

2665

01:45:05,669 --> 01:45:03,520

in front of you

2666

01:45:06,870 --> 01:45:05,679

you should be able to catch up that way

2667

01:45:07,590 --> 01:45:06,880

because you're crunching space in front

2668

01:45:10,229 --> 01:45:07,600

of you

2669

01:45:11,189 --> 01:45:10,239

but if you exceed the speed of light

2670

01:45:14,629 --> 01:45:11,199

you're beyond

2671

01:45:17,669 --> 01:45:14,639

infinite mass and energy

2672

01:45:19,030 --> 01:45:17,679

what kind of what kind of horsepower are

2673

01:45:20,310 --> 01:45:19,040

we talking here

2674

01:45:21,430 --> 01:45:20,320

well it's an interesting thought is

2675

01:45:23,030 --> 01:45:21,440

because you should have infinite energy

2676
01:45:25,109 --> 01:45:23,040
at those galaxies that are moving away

2677
01:45:27,430 --> 01:45:25,119
but uh that's what we often mean about

2678
01:45:28,550 --> 01:45:27,440
you know conservation of energy is not

2679
01:45:31,510 --> 01:45:28,560
it does not hold up

2680
01:45:33,030 --> 01:45:31,520
at the cosmological scale uh it isn't

2681
01:45:35,109 --> 01:45:33,040
violated locally but that the

2682
01:45:37,109 --> 01:45:35,119
cosmological scale kind of breaks down

2683
01:45:38,629 --> 01:45:37,119
the kubio drive is working by not moving

2684
01:45:40,070 --> 01:45:38,639
you at any speed at all it's crunching

2685
01:45:41,590 --> 01:45:40,080
space in front of you so

2686
01:45:43,669 --> 01:45:41,600
the same effect that's happening where

2687
01:45:45,430 --> 01:45:43,679
it's creating random bits of space

2688
01:45:46,550 --> 01:45:45,440

to increase the volume of the universe

2689

01:45:48,070 --> 01:45:46,560

you're doing the reverse thing where

2690

01:45:49,750 --> 01:45:48,080

you're basically crunching down bits of

2691

01:45:50,310 --> 01:45:49,760

space and that should allow you to catch

2692

01:45:51,990 --> 01:45:50,320

up

2693

01:45:53,350 --> 01:45:52,000

so if that particular one worked yeah

2694

01:45:55,430 --> 01:45:53,360

could be a warp drive

2695

01:45:57,669 --> 01:45:55,440

or a few other versions that are similar

2696

01:45:59,430 --> 01:45:57,679

that should let you actually catch up

2697

01:46:00,709 --> 01:45:59,440

and leave the local value of space what

2698

01:46:02,470 --> 01:46:00,719

we call the observable value in the

2699

01:46:03,910 --> 01:46:02,480

space the observable universe or

2700

01:46:05,910 --> 01:46:03,920

not quite the same thing but the hubble

2701

01:46:06,950 --> 01:46:05,920

value in that which we live um

2702

01:46:08,870 --> 01:46:06,960

that's one of the ways you could

2703

01:46:09,990 --> 01:46:08,880

hypothetically do that where's the

2704

01:46:18,390 --> 01:46:10,000

energy

2705

01:46:21,590 --> 01:46:18,400

uh start to get too big

2706

01:46:23,430 --> 01:46:21,600

to catch up to the edge of the universe

2707

01:46:24,870 --> 01:46:23,440

if you were traveling classically yes

2708

01:46:27,270 --> 01:46:24,880

but the warp drive thing which

2709

01:46:28,550 --> 01:46:27,280

actually relies on negative energy um

2710

01:46:31,030 --> 01:46:28,560

which is a whole another

2711

01:46:32,229 --> 01:46:31,040

uh you know another can of worms uh

2712

01:46:33,750 --> 01:46:32,239

should allow you to circumvent that

2713

01:46:35,270 --> 01:46:33,760

entire issue there should be no

2714

01:46:36,870 --> 01:46:35,280

kinetic energy involved in traveling

2715

01:46:38,470 --> 01:46:36,880

that distance because again it's

2716

01:46:39,910 --> 01:46:38,480

random bits of matter popping up if

2717

01:46:40,790 --> 01:46:39,920

you're trying to go through those

2718

01:46:42,790 --> 01:46:40,800

distances

2719

01:46:43,910 --> 01:46:42,800

then you have to move fast you have to

2720

01:46:44,550 --> 01:46:43,920

have that kinetic energy but if you're

2721

01:46:46,390 --> 01:46:44,560

just

2722

01:46:47,590 --> 01:46:46,400

removing those essentially it's to

2723

01:46:49,350 --> 01:46:47,600

suggest that we could pop from the one

2724

01:46:50,310 --> 01:46:49,360

university outside the universe with uh

2725

01:46:52,390 --> 01:46:50,320

40 in space

2726

01:46:54,550 --> 01:46:52,400

that's essentially how the rqbio drive

2727

01:46:56,229 --> 01:46:54,560

would work in a case like that only

2728

01:46:58,310 --> 01:46:56,239

in a straight line it's basically your

2729

01:47:00,870 --> 01:46:58,320

warp drive star track

2730

01:47:01,750 --> 01:47:00,880

um as opposed to like the dune style

2731

01:47:04,550 --> 01:47:01,760

space forty

2732

01:47:05,990 --> 01:47:04,560

right um but uh those kind of let you

2733

01:47:09,030 --> 01:47:06,000

get around it but

2734

01:47:10,550 --> 01:47:09,040

i am on the uh high skepticism side of

2735

01:47:11,910 --> 01:47:10,560

the alcubierre drive i would not expect

2736

01:47:13,590 --> 01:47:11,920

that to ever walk or any other things

2737

01:47:15,189 --> 01:47:13,600

like warm horse walk i've

2738

01:47:17,030 --> 01:47:15,199

never found a negative mass particle

2739

01:47:18,950 --> 01:47:17,040

before yeah until they find one of those

2740

01:47:20,830 --> 01:47:18,960

yeah yeah you know who bummed me out

2741

01:47:23,669 --> 01:47:20,840

about that

2742

01:47:24,310 --> 01:47:23,679

him oh yeah well it's unfair it's people

2743

01:47:25,590 --> 01:47:24,320

say well

2744

01:47:27,350 --> 01:47:25,600

you disagree with him he's like no he

2745

01:47:28,149 --> 01:47:27,360

doesn't think it works he doesn't think

2746

01:47:31,270 --> 01:47:28,159

it works either

2747

01:47:33,990 --> 01:47:31,280

you know and and he can describe it

2748

01:47:35,030 --> 01:47:34,000

right he's the one that wrote it up he's

2749

01:47:37,109 --> 01:47:35,040

the one

2750

01:47:38,709 --> 01:47:37,119

and then well you know but it's

2751
01:47:41,109 --> 01:47:38,719
impossible like dude

2752
01:47:42,149 --> 01:47:41,119
you had me you know you had me at one

2753
01:47:44,709 --> 01:47:42,159
point well

2754
01:47:46,470 --> 01:47:44,719
it's it's not necessarily impossible we

2755
01:47:48,229 --> 01:47:46,480
can't prove it's impossible yet it's a

2756
01:47:49,270 --> 01:47:48,239
wonderful idea it's but it probably does

2757
01:47:50,790 --> 01:47:49,280
not work and

2758
01:47:52,390 --> 01:47:50,800
you know i it's the thing i like to do

2759
01:47:54,310 --> 01:47:52,400
about the field is to say i want you

2760
01:47:54,629 --> 01:47:54,320
guys unfairly skeptical new ideas like

2761
01:47:56,310 --> 01:47:54,639
no

2762
01:47:57,750 --> 01:47:56,320
when folks all feel completely free to

2763
01:47:58,870 --> 01:47:57,760

publish that and

2764

01:48:00,149 --> 01:47:58,880

everybody else in the future says that's

2765

01:48:00,870 --> 01:48:00,159

a great idea probably doesn't work but

2766

01:48:02,830 --> 01:48:00,880

great idea

2767

01:48:03,990 --> 01:48:02,840

but still open-minded you can have the

2768

01:48:07,030 --> 01:48:04,000

patent

2769

01:48:09,669 --> 01:48:07,040

just go just go now if

2770

01:48:11,350 --> 01:48:09,679

uh if this is the case i almost wanted

2771

01:48:14,310 --> 01:48:11,360

to ask you what side of the fence

2772

01:48:16,950 --> 01:48:14,320

you are on when we are talking about the

2773

01:48:20,229 --> 01:48:16,960

universe are you an expansionist

2774

01:48:23,430 --> 01:48:20,239

you know how do you uh do

2775

01:48:26,229 --> 01:48:23,440

do you consider the universe infinite

2776

01:48:27,910 --> 01:48:26,239

yes uh that's not a provable thing of

2777

01:48:29,109 --> 01:48:27,920

course you can never prove anything is

2778

01:48:31,350 --> 01:48:29,119

is infinite

2779

01:48:32,629 --> 01:48:31,360

uh but i tend to philosophically work on

2780

01:48:35,189 --> 01:48:32,639

the assumption that the

2781

01:48:37,109 --> 01:48:35,199

sum total reality uh whether you want to

2782

01:48:38,149 --> 01:48:37,119

call it the universe not is infinite

2783

01:48:40,070 --> 01:48:38,159

but i tend to think there's a pretty

2784

01:48:40,950 --> 01:48:40,080

good chance that this universal in is

2785

01:48:42,470 --> 01:48:40,960

infinite

2786

01:48:43,910 --> 01:48:42,480

and then we talk about the big bang that

2787

01:48:45,270 --> 01:48:43,920

would just be our observable chunk that

2788

01:48:46,310 --> 01:48:45,280

was point like it may already been

2789

01:48:48,870 --> 01:48:46,320

infinite before then

2790

01:48:50,310 --> 01:48:48,880

sure um but there's also kind of a limit

2791

01:48:51,990 --> 01:48:50,320

on infinity because

2792

01:48:53,590 --> 01:48:52,000

any infinite system where you're dealing

2793

01:48:55,030 --> 01:48:53,600

with finite portions of it you're going

2794

01:48:57,189 --> 01:48:55,040

to start replicating you're going to

2795

01:48:59,109 --> 01:48:57,199

have things like exact copies

2796

01:49:01,510 --> 01:48:59,119

and i'm not convinced there's a strictly

2797

01:49:03,590 --> 01:49:01,520

philosophical argument that

2798

01:49:04,550 --> 01:49:03,600

two things are identical are the same

2799

01:49:06,550 --> 01:49:04,560

thing

2800

01:49:08,950 --> 01:49:06,560

you know how many can you have more than

2801
01:49:12,470 --> 01:49:08,960
one copy of shakespeare's tempest

2802
01:49:13,990 --> 01:49:12,480
yes it's still just one copy if i pop

2803
01:49:16,310 --> 01:49:14,000
back up into resistance on a complete

2804
01:49:17,990 --> 01:49:16,320
perfect copy of earth down the atom with

2805
01:49:19,430 --> 01:49:18,000
the exact same thoughts exact same life

2806
01:49:20,470 --> 01:49:19,440
just by quantum freakiness and a

2807
01:49:21,830 --> 01:49:20,480
multiverse

2808
01:49:23,830 --> 01:49:21,840
or the universe repeating because it's

2809
01:49:25,030 --> 01:49:23,840
just so infinite in size that sequence

2810
01:49:28,149 --> 01:49:25,040
of events has happened again

2811
01:49:30,070 --> 01:49:28,159
right yeah so in that context

2812
01:49:31,589 --> 01:49:30,080
i don't think a finite universe like the

2813
01:49:33,990 --> 01:49:31,599

one we're in can actually be

2814

01:49:35,669 --> 01:49:34,000

infinite in that in that sense but i

2815

01:49:36,950 --> 01:49:35,679

tend to assume that some total reality

2816

01:49:38,950 --> 01:49:36,960

is yeah well

2817

01:49:40,070 --> 01:49:38,960

particles can only combine so many

2818

01:49:43,109 --> 01:49:40,080

different ways

2819

01:49:45,270 --> 01:49:43,119

exactly so there has to be

2820

01:49:48,390 --> 01:49:45,280

i mean it's just a numbers game there

2821

01:49:51,510 --> 01:49:48,400

has to be 10 to the 10 to the 77th

2822

01:49:54,550 --> 01:49:51,520

there has to be a lot of versions of us

2823

01:49:56,629 --> 01:49:54,560

out there but does consciousness repeat

2824

01:49:59,030 --> 01:49:56,639

like you know there may be a shakespeare

2825

01:50:01,589 --> 01:49:59,040

buddy is he writing the same books

2826
01:50:03,109 --> 01:50:01,599
right and and he presumably didn't there

2827
01:50:04,229 --> 01:50:03,119
should be a lot more versions of him you

2828
01:50:05,750 --> 01:50:04,239
know for every copy of a book that would

2829
01:50:06,790 --> 01:50:05,760
be identical but the one with the period

2830
01:50:08,629 --> 01:50:06,800
was one

2831
01:50:10,070 --> 01:50:08,639
millionth of an inch to the right wow

2832
01:50:11,189 --> 01:50:10,080
and that's but that's the same thing

2833
01:50:13,910 --> 01:50:11,199
more or less

2834
01:50:14,709 --> 01:50:13,920
the duplicate versions of us are not

2835
01:50:21,350 --> 01:50:14,719
talking about

2836
01:50:22,950 --> 01:50:21,360
right or or or whatever or we'll have

2837
01:50:23,589 --> 01:50:22,960
the exact same conversation but i have

2838
01:50:26,870 --> 01:50:23,599

one

2839

01:50:29,270 --> 01:50:26,880

eyebrow hair and that's the only

2840

01:50:31,830 --> 01:50:29,280

difference in the entire universe

2841

01:50:33,510 --> 01:50:31,840

in that other universe i actually have

2842

01:50:37,350 --> 01:50:33,520

eyebrows

2843

01:50:39,990 --> 01:50:37,360

okay now uh inside joke

2844

01:50:41,669 --> 01:50:40,000

will we ever the the current

2845

01:50:43,669 --> 01:50:41,679

calculations the current numbers and

2846

01:50:46,790 --> 01:50:43,679

they go up every day but right now

2847

01:50:49,830 --> 01:50:46,800

the the high side of galaxies

2848

01:50:50,629 --> 01:50:49,840

in the universe is a trillion it used to

2849

01:50:53,270 --> 01:50:50,639

be a hundred

2850

01:50:54,310 --> 01:50:53,280

you know 100 billion then it was 200 250

2851
01:50:57,350 --> 01:50:54,320
and it was 500

2852
01:51:00,070 --> 01:50:57,360
now we're talking about a trillion but

2853
01:51:00,550 --> 01:51:00,080
with the expansion and at the speed of

2854
01:51:03,030 --> 01:51:00,560
light

2855
01:51:05,430 --> 01:51:03,040
things are disappearing at ftl they've

2856
01:51:08,629 --> 01:51:05,440
already disappeared

2857
01:51:11,990 --> 01:51:08,639
will we ever know that the real number

2858
01:51:14,629 --> 01:51:12,000
isn't a trillion it's trillion to the

2859
01:51:16,149 --> 01:51:14,639
to the 100th power it will eventually be

2860
01:51:18,950 --> 01:51:16,159
one

2861
01:51:19,990 --> 01:51:18,960
yeah about 100 billion years yeah um

2862
01:51:21,430 --> 01:51:20,000
probably reason for the number

2863
01:51:23,910 --> 01:51:21,440

changing is if you're looking back in

2864

01:51:25,430 --> 01:51:23,920

time all galaxies are cannibal

2865

01:51:27,750 --> 01:51:25,440

it's it's it's roughly tied with

2866

01:51:30,229 --> 01:51:27,760

andromeda for mass uh 30 round does

2867

01:51:31,830 --> 01:51:30,239

and it has eaten galaxy after galaxy

2868

01:51:33,589 --> 01:51:31,840

after galaxy we can start to see the

2869

01:51:35,350 --> 01:51:33,599

trace leftovers of these

2870

01:51:37,350 --> 01:51:35,360

galaxies we consume so we look with the

2871

01:51:38,950 --> 01:51:37,360

for the far ones looking back in time

2872

01:51:40,149 --> 01:51:38,960

when galaxies tend to be smaller so

2873

01:51:40,950 --> 01:51:40,159

that's part of the uncertainty in the

2874

01:51:42,310 --> 01:51:40,960

number

2875

01:51:44,310 --> 01:51:42,320

early on the universe they were more

2876
01:51:45,910 --> 01:51:44,320
galaxies now they're more than a bigger

2877
01:51:47,109 --> 01:51:45,920
and heavier but we're losing galaxies

2878
01:51:49,109 --> 01:51:47,119
all the time to the edge of the universe

2879
01:51:50,629 --> 01:51:49,119
too even as the edge of the universe

2880
01:51:54,709 --> 01:51:50,639
expands

2881
01:51:59,189 --> 01:51:54,719
they're dropping off the edge constantly

2882
01:52:02,149 --> 01:51:59,199
um now with that expansion

2883
01:52:03,669 --> 01:52:02,159
the the chatter over the last 10 years

2884
01:52:06,870 --> 01:52:03,679
has been

2885
01:52:10,229 --> 01:52:06,880
dark energy which apparently is

2886
01:52:12,550 --> 01:52:10,239
gravity in reverse and

2887
01:52:14,550 --> 01:52:12,560
and gravity is a fascinating thing you

2888
01:52:14,870 --> 01:52:14,560

and i should do a whole show on gravity

2889

01:52:17,510 --> 01:52:14,880

uh

2890

01:52:18,950 --> 01:52:17,520

in the future that would be a great show

2891

01:52:22,790 --> 01:52:18,960

but

2892

01:52:25,830 --> 01:52:22,800

how is it possible that

2893

01:52:26,870 --> 01:52:25,840

over these vast distances of space and

2894

01:52:29,990 --> 01:52:26,880

time

2895

01:52:32,229 --> 01:52:30,000

that dark energy can increase

2896

01:52:34,229 --> 01:52:32,239

the pressure going out into the

2897

01:52:37,510 --> 01:52:34,239

expansion

2898

01:52:40,629 --> 01:52:37,520

doesn't it won't it eventually thin

2899

01:52:43,109 --> 01:52:40,639

out won't dark energy

2900

01:52:44,070 --> 01:52:43,119

lose its juice is it possible that the

2901

01:52:47,510 --> 01:52:44,080

expansion could

2902

01:52:50,070 --> 01:52:47,520

stop because dark energy is is too

2903

01:52:51,350 --> 01:52:50,080

thin sure yeah one of the problems we

2904

01:52:52,709 --> 01:52:51,360

have with dark energy i was saying

2905

01:52:54,870 --> 01:52:52,719

earlier that there was a

2906

01:52:56,629 --> 01:52:54,880

little bits of space you know pop you up

2907

01:52:57,270 --> 01:52:56,639

into in reality here and there on plank

2908

01:52:58,629 --> 01:52:57,280

volumes

2909

01:52:59,830 --> 01:52:58,639

we don't know that for sure that's a

2910

01:53:01,109 --> 01:52:59,840

popular one and where i tend to

2911

01:53:02,229 --> 01:53:01,119

subscribe to myself but

2912

01:53:03,430 --> 01:53:02,239

there's no evidence to back that

2913

01:53:04,149 --> 01:53:03,440

particular one up for where this is

2914

01:53:05,510 --> 01:53:04,159

coming from

2915

01:53:07,750 --> 01:53:05,520

we know space is appearing out of

2916

01:53:09,430 --> 01:53:07,760

nowhere we say that this effect because

2917

01:53:10,229 --> 01:53:09,440

space has energy associated is dog

2918

01:53:11,750 --> 01:53:10,239

energy

2919

01:53:13,350 --> 01:53:11,760

that is everything we know about it

2920

01:53:15,669 --> 01:53:13,360

other than the fact that it seems to be

2921

01:53:16,629 --> 01:53:15,679

expanding and coming into existence even

2922

01:53:18,790 --> 01:53:16,639

faster

2923

01:53:19,990 --> 01:53:18,800

as time has gone on where is it coming

2924

01:53:21,510 --> 01:53:20,000

from could it run out

2925

01:53:22,709 --> 01:53:21,520

sure and we can answer that question as

2926
01:53:24,310 --> 01:53:22,719
soon as we figure out where is it coming

2927
01:53:26,310 --> 01:53:24,320
from we have no idea

2928
01:53:27,669 --> 01:53:26,320
is it leaking in from another universe

2929
01:53:28,149 --> 01:53:27,679
does it need to leak in from the other

2930
01:53:29,830 --> 01:53:28,159
side

2931
01:53:31,270 --> 01:53:29,840
so does it simply pop up is it a

2932
01:53:33,910 --> 01:53:31,280
property of the universe that

2933
01:53:34,629 --> 01:53:33,920
as they age more space appears in them

2934
01:53:36,390 --> 01:53:34,639
i've you know

2935
01:53:38,629 --> 01:53:36,400
suggested that because of so many states

2936
01:53:39,669 --> 01:53:38,639
the universe can be in as it expands it

2937
01:53:41,030 --> 01:53:39,679
needs to

2938
01:53:42,070 --> 01:53:41,040

have more energy to cover that and

2939

01:53:43,589 --> 01:53:42,080

that's what this is you know

2940

01:53:45,669 --> 01:53:43,599

representing itself as

2941

01:53:47,109 --> 01:53:45,679

uh we can't say that it definitely is

2942

01:53:48,950 --> 01:53:47,119

the reverse of gravity that's not the

2943

01:53:49,830 --> 01:53:48,960

popular one that's tied to gravity in

2944

01:53:52,229 --> 01:53:49,840

some way

2945

01:53:53,270 --> 01:53:52,239

i would tend to expect it is but we

2946

01:53:56,709 --> 01:53:53,280

don't know that yet

2947

01:53:58,070 --> 01:53:56,719

you know now there was uh so many

2948

01:54:01,270 --> 01:53:58,080

question marks were talking

2949

01:54:05,189 --> 01:54:01,280

there are and and one of them

2950

01:54:07,589 --> 01:54:05,199

for me is this okay we've got

2951
01:54:08,229 --> 01:54:07,599
we've got gravity at the atomic level

2952
01:54:10,149 --> 01:54:08,239
we've got

2953
01:54:11,830 --> 01:54:10,159
quartz and electrons and things and

2954
01:54:15,030 --> 01:54:11,840
spinning around holding

2955
01:54:17,350 --> 01:54:15,040
uh uh particles and molecules and as

2956
01:54:19,109 --> 01:54:17,360
you know cells and every you know you

2957
01:54:22,950 --> 01:54:19,119
know you get bigger and bigger

2958
01:54:25,030 --> 01:54:22,960
um like a russian doll where gravity

2959
01:54:26,790 --> 01:54:25,040
you know from the very smallest is is

2960
01:54:28,229 --> 01:54:26,800
holding it then you get to the earth

2961
01:54:30,070 --> 01:54:28,239
right then we have that and then we have

2962
01:54:30,790 --> 01:54:30,080
the gravity that's holding the moon here

2963
01:54:33,669 --> 01:54:30,800

then we have

2964

01:54:35,430 --> 01:54:33,679

the gravity that the sun is not at the

2965

01:54:38,070 --> 01:54:35,440

center of the solar system it's

2966

01:54:38,470 --> 01:54:38,080

actually moving around the center part

2967

01:54:40,709 --> 01:54:38,480

of the

2968

01:54:42,790 --> 01:54:40,719

with gas it's it's absolutely

2969

01:54:43,830 --> 01:54:42,800

fascinating and then you get outside of

2970

01:54:47,510 --> 01:54:43,840

our solar system

2971

01:54:50,790 --> 01:54:47,520

into the galaxy we've got a spiral um

2972

01:54:53,510 --> 01:54:50,800

why isn't dark energy

2973

01:54:54,870 --> 01:54:53,520

pulling the galaxy apart why isn't it

2974

01:54:56,790 --> 01:54:54,880

that we

2975

01:54:58,149 --> 01:54:56,800

don't have you know when you spin

2976

01:55:00,950 --> 01:54:58,159

something why aren't

2977

01:55:02,830 --> 01:55:00,960

stars getting flinged off the edge of

2978

01:55:05,990 --> 01:55:02,840

the galaxy

2979

01:55:08,229 --> 01:55:06,000

um oh yeah no we eject tons of

2980

01:55:10,310 --> 01:55:08,239

stars out of the galaxy all the time the

2981

01:55:12,950 --> 01:55:10,320

galaxy is still a spiral

2982

01:55:13,510 --> 01:55:12,960

and and has structure and so what i'm

2983

01:55:16,310 --> 01:55:13,520

saying

2984

01:55:18,070 --> 01:55:16,320

is this we have all of these different

2985

01:55:19,669 --> 01:55:18,080

elements with gravity

2986

01:55:21,910 --> 01:55:19,679

where we've got the expansion of the

2987

01:55:23,669 --> 01:55:21,920

universe we've got dark energy but yet

2988

01:55:26,310 --> 01:55:23,679

we have these clusters

2989

01:55:28,470 --> 01:55:26,320
of gravity around black holes at the

2990

01:55:31,109 --> 01:55:28,480
center of these galaxies

2991

01:55:32,149 --> 01:55:31,119
holding the galaxies together when you

2992

01:55:35,189 --> 01:55:32,159
have dark energy

2993

01:55:38,229 --> 01:55:35,199
pulling the rest of everything apart

2994

01:55:40,950 --> 01:55:38,239
how is how is it possible to to

2995

01:55:42,870 --> 01:55:40,960
have this at the same time i don't

2996

01:55:44,229 --> 01:55:42,880
understand

2997

01:55:46,390 --> 01:55:44,239
if it were even just a little bit

2998

01:55:47,910 --> 01:55:46,400
stronger and the big rip theory for

2999

01:55:48,870 --> 01:55:47,920
instance says that it gets stronger and

3000

01:55:50,790 --> 01:55:48,880
stronger with time

3001
01:55:52,149 --> 01:55:50,800
it would rip apart even the galaxies and

3002
01:55:53,830 --> 01:55:52,159
if god if it was getting stronger or

3003
01:55:56,390 --> 01:55:53,840
strong would eventually tear apart stars

3004
01:55:57,510 --> 01:55:56,400
tear apart atoms tear part quarks which

3005
01:55:59,350 --> 01:55:57,520
is an interesting one because we start

3006
01:56:00,629 --> 01:55:59,360
tearing corks apart you make more quarks

3007
01:56:02,550 --> 01:56:00,639
which kind of result in potentially

3008
01:56:04,790 --> 01:56:02,560
another big bang right on the spot

3009
01:56:06,790 --> 01:56:04,800
but um it's not strong enough to pull

3010
01:56:08,310 --> 01:56:06,800
apart galaxies because the galaxies have

3011
01:56:09,910 --> 01:56:08,320
a lot of gravity holding them together

3012
01:56:11,669 --> 01:56:09,920
but it's starting to pull apart galaxies

3013
01:56:13,189 --> 01:56:11,679

from each other um

3014

01:56:14,709 --> 01:56:13,199

almost every galaxy universe is being

3015

01:56:15,750 --> 01:56:14,719

pulled apart by dark energy

3016

01:56:17,990 --> 01:56:15,760

more than the gravity is holding

3017

01:56:19,990 --> 01:56:18,000

together with those other bits uh but

3018

01:56:20,390 --> 01:56:20,000

it's kind of like why don't uh you know

3019

01:56:23,589 --> 01:56:20,400

why

3020

01:56:25,030 --> 01:56:23,599

instead of gravity pointing it down

3021

01:56:27,270 --> 01:56:25,040

because other various forces are acting

3022

01:56:28,790 --> 01:56:27,280

on it that are stronger than gravity is

3023

01:56:31,510 --> 01:56:28,800

that location

3024

01:56:32,390 --> 01:56:31,520

gravity is gravity is a freak force it's

3025

01:56:35,510 --> 01:56:32,400

it's very weak

3026

01:56:37,189 --> 01:56:35,520

um but it's the only one that has only a

3027

01:56:37,990 --> 01:56:37,199

positive influence so at the galactic

3028

01:56:40,629 --> 01:56:38,000

scale

3029

01:56:42,629 --> 01:56:40,639

it dominates things then you get another

3030

01:56:45,830 --> 01:56:42,639

galactic scale and suddenly dark energy

3031

01:56:48,229 --> 01:56:45,840

dominates things at the solar scale uh

3032

01:56:50,229 --> 01:56:48,239

gravity is pretty dominant at the

3033

01:56:52,310 --> 01:56:50,239

planetary scale it's

3034

01:56:54,229 --> 01:56:52,320

a major factor but it's starting to get

3035

01:56:56,149 --> 01:56:54,239

weaker at the personal scale gravity is

3036

01:56:59,270 --> 01:56:56,159

almost nothing um

3037

01:57:03,990 --> 01:56:59,280

and we don't know why that is either so

3038

01:57:07,910 --> 01:57:04,000

well to have influence uh i'm pluto

3039

01:57:10,310 --> 01:57:07,920

right and and and uh

3040

01:57:12,229 --> 01:57:10,320

most people don't understand how big our

3041

01:57:16,070 --> 01:57:12,239

solar system is

3042

01:57:19,350 --> 01:57:16,080

it's freaking big in the universe

3043

01:57:22,470 --> 01:57:19,360

in our galaxy it's nothing right but

3044

01:57:25,669 --> 01:57:22,480

on the scales of what we are here

3045

01:57:29,109 --> 01:57:25,679

it's huge and the distances going out

3046

01:57:32,550 --> 01:57:29,119

to pluto and beyond and having

3047

01:57:35,830 --> 01:57:32,560

gravity uh hold it in place

3048

01:57:38,550 --> 01:57:35,840

for its uh orbit from the sun

3049

01:57:39,350 --> 01:57:38,560

is is mind-blowing and it's such a weak

3050

01:57:41,030 --> 01:57:39,360

force

3051
01:57:42,790 --> 01:57:41,040
our brains can't even wrap around the

3052
01:57:44,790 --> 01:57:42,800
scale involved if you know if

3053
01:57:46,149 --> 01:57:44,800
math lets us do it but otherwise you

3054
01:57:47,669 --> 01:57:46,159
know we think about how big the universe

3055
01:57:48,790 --> 01:57:47,679
is people say the universe is big and

3056
01:57:50,470 --> 01:57:48,800
they're still thinking of the entire

3057
01:57:51,589 --> 01:57:50,480
universe a scale that's smaller than our

3058
01:57:52,790 --> 01:57:51,599
solar system

3059
01:57:54,709 --> 01:57:52,800
because our brains can't wrap our heads

3060
01:57:56,550 --> 01:57:54,719
around that you know it's like when

3061
01:57:58,149 --> 01:57:56,560
people say oh cells you know these cells

3062
01:57:59,750 --> 01:57:58,159
are atoms and cells are a little bit

3063
01:58:01,750 --> 01:57:59,760

bigger than atoms say well

3064

01:58:03,589 --> 01:58:01,760

how big do you think they are see if an

3065

01:58:04,950 --> 01:58:03,599

atom was a brick then a cell like a

3066

01:58:06,470 --> 01:58:04,960

break you build a house out of say a

3067

01:58:08,950 --> 01:58:06,480

cell is a house no

3068

01:58:10,550 --> 01:58:08,960

a cell is like a city they're made out

3069

01:58:12,709 --> 01:58:10,560

of a trillion bricks

3070

01:58:15,189 --> 01:58:12,719

we have a really bad sense of scale

3071

01:58:19,189 --> 01:58:15,199

because our brains can't wrap around it

3072

01:58:19,430 --> 01:58:19,199

and the universe is just stupidly huge

3073

01:58:20,790 --> 01:58:19,440

and

3074

01:58:22,709 --> 01:58:20,800

still tiny could probably compare the

3075

01:58:25,350 --> 01:58:22,719

rest of reality probably

3076

01:58:26,709 --> 01:58:25,360

and and this is where uh we're going to

3077

01:58:28,229 --> 01:58:26,719

come back and talk about the fermi

3078

01:58:29,350 --> 01:58:28,239

paradox we're going to tie all of this

3079

01:58:32,870 --> 01:58:29,360

together but

3080

01:58:36,229 --> 01:58:32,880

um is this where philosophy

3081

01:58:40,149 --> 01:58:36,239

needs to bring in its influence

3082

01:58:44,070 --> 01:58:40,159

on on physics and science where

3083

01:58:47,830 --> 01:58:44,080

how is it possible that dark energy

3084

01:58:49,669 --> 01:58:47,840

and gravity and particles enjoy this

3085

01:58:53,350 --> 01:58:49,679

life together

3086

01:58:55,510 --> 01:58:53,360

by chance right that's that's the part

3087

01:58:56,310 --> 01:58:55,520

that i think philosophy needs to get in

3088

01:59:00,709 --> 01:58:56,320

and there's a

3089

01:59:02,229 --> 01:59:00,719

bigger explanation here than coincidence

3090

01:59:03,750 --> 01:59:02,239

that's one of the ones that's uh popped

3091

01:59:04,310 --> 01:59:03,760

up as an example of how we compare the

3092

01:59:05,750 --> 01:59:04,320

component

3093

01:59:07,430 --> 01:59:05,760

principle mediocrity principle with the

3094

01:59:09,669 --> 01:59:07,440

anthropic principle and

3095

01:59:10,629 --> 01:59:09,679

and things like fine-tuned universe and

3096

01:59:11,990 --> 01:59:10,639

that is

3097

01:59:14,149 --> 01:59:12,000

also another one of those things you

3098

01:59:17,510 --> 01:59:14,159

that is very strange so

3099

01:59:19,270 --> 01:59:17,520

well and okay and uh we'll come back and

3100

01:59:22,629 --> 01:59:19,280

talk about the fermi paradox

3101

01:59:26,310 --> 01:59:22,639

but is it interesting to you

3102

01:59:29,750 --> 01:59:26,320

that the big bang theory

3103

01:59:32,629 --> 01:59:29,760

is now in question where it's even

3104

01:59:33,990 --> 01:59:32,639

talked about that it's possible that it

3105

01:59:35,830 --> 01:59:34,000

may not have happened

3106

01:59:38,550 --> 01:59:35,840

that's pretty did you ever think that we

3107

01:59:40,229 --> 01:59:38,560

would arrive to this kind of moment

3108

01:59:42,229 --> 01:59:40,239

you know when i was first learning stuff

3109

01:59:43,589 --> 01:59:42,239

in the 80s as a kid uh someone was

3110

01:59:43,990 --> 01:59:43,599

kicking around eric lorna was kicking

3111

01:59:45,750 --> 01:59:44,000

out the idea

3112

01:59:47,109 --> 01:59:45,760

that big bang may never have happened

3113

01:59:48,390 --> 01:59:47,119

never reading that book and so i've

3114

01:59:49,589 --> 01:59:48,400

always assumed there was a decent chance

3115

01:59:50,310 --> 01:59:49,599

but the theory might have some bits

3116

01:59:52,149 --> 01:59:50,320

wrong with it

3117

01:59:54,229 --> 01:59:52,159

now he was right into plasma cosmology

3118

01:59:55,990 --> 01:59:54,239

which hasn't filled up too well in

3119

01:59:58,550 --> 01:59:56,000

modern cosmology theories but

3120

01:59:59,589 --> 01:59:58,560

uh yeah i mean the big bang is a loose

3121

02:00:01,350 --> 01:59:59,599

idea for the assumption that the

3122

02:00:03,189 --> 02:00:01,360

universe used to be a lot smaller

3123

02:00:04,950 --> 02:00:03,199

we can only look back until the universe

3124

02:00:06,870 --> 02:00:04,960

is 300 thousand years old or it might be

3125

02:00:07,910 --> 02:00:06,880

wacky to say we can only look back 13.7

3126
02:00:10,629 --> 02:00:07,920
billion years

3127
02:00:12,070 --> 02:00:10,639
and what we see is a big wall of plasma

3128
02:00:15,109 --> 02:00:12,080
and that's only because

3129
02:00:18,149 --> 02:00:15,119
of of of measurement of

3130
02:00:18,550 --> 02:00:18,159
of of temperature and radiation and of

3131
02:00:21,589 --> 02:00:18,560
course

3132
02:00:23,990 --> 02:00:21,599
einstein's original numbers

3133
02:00:25,510 --> 02:00:24,000
basically einstein hubble shift and and

3134
02:00:27,350 --> 02:00:25,520
at cmbo

3135
02:00:28,950 --> 02:00:27,360
my wave background radiation we look at

3136
02:00:30,550 --> 02:00:28,960
that we look at the expansion that seems

3137
02:00:31,669 --> 02:00:30,560
to be going on things eventually away

3138
02:00:33,430 --> 02:00:31,679

and we say

3139

02:00:35,350 --> 02:00:33,440

that's when it was close together that

3140

02:00:37,030 --> 02:00:35,360

is not all the evidence we got for that

3141

02:00:38,870 --> 02:00:37,040

we have developed more of the years

3142

02:00:40,310 --> 02:00:38,880

and there are things that would argue

3143

02:00:41,830 --> 02:00:40,320

against it here and there but

3144

02:00:43,589 --> 02:00:41,840

it's currently the solidest theory we've

3145

02:00:46,070 --> 02:00:43,599

got by the university and

3146

02:00:47,990 --> 02:00:46,080

and it holds up pretty well oh man i

3147

02:00:50,709 --> 02:00:48,000

love this conversation our guest tonight

3148

02:00:53,270 --> 02:00:50,719

isaac arthur i am your host jimmy church

3149

02:00:54,790 --> 02:00:53,280

this is fade to black more with isaac

3150

02:00:56,950 --> 02:00:54,800

when we come back after this

3151

02:00:58,790 --> 02:00:56,960

a very short break and we're going to

3152

02:01:01,189 --> 02:00:58,800

talk about the fermi paradox

3153

02:01:08,550 --> 02:01:01,199

i have a way to tie it all together

3154

02:01:09,990 --> 02:01:08,560

we'll be right back

3155

02:01:16,149 --> 02:01:10,000

hi everybody this is rob halpert the

3156

02:01:19,750 --> 02:01:18,709

this is kgra digital broadcasting

3157

02:01:23,350 --> 02:01:19,760

station

3158

02:01:25,189 --> 02:01:23,360

salt lake city utah van buren arkansas

3159

02:01:27,350 --> 02:01:25,199

why is it we're not very good with our

3160

02:01:28,709 --> 02:01:27,360

health regiment until it's too late we

3161

02:01:30,229 --> 02:01:28,719

don't put oil in the car

3162

02:01:32,470 --> 02:01:30,239

until the engine blows up when the

3163

02:01:34,950 --> 02:01:32,480

body's out of balance your health

3164

02:01:35,990 --> 02:01:34,960

is not so good give your body some love

3165

02:01:39,189 --> 02:01:36,000

log on to get the

3166

02:01:41,109 --> 02:01:39,199

tea.com that's get the tea dot com try

3167

02:01:42,870 --> 02:01:41,119

our life change tea which cleanses you

3168

02:01:45,030 --> 02:01:42,880

from harmful intruders

3169

02:01:46,550 --> 02:01:45,040

a clean colon is one of the ways to

3170

02:01:48,550 --> 02:01:46,560

bring the body in balance

3171

02:01:50,790 --> 02:01:48,560

we also carry organic supplements to

3172

02:01:53,109 --> 02:01:50,800

help you get where you need to go

3173

02:01:57,189 --> 02:01:53,119

so do your body a favor log on to get

3174

02:01:59,430 --> 02:01:57,199

the tea.com that's get the ttea.com

3175

02:02:00,709 --> 02:01:59,440

you can even visit our sales page to

3176

02:02:02,950 --> 02:02:00,719

save some dough

3177

02:02:04,629 --> 02:02:02,960

does anybody call money dough anymore

3178

02:02:05,910 --> 02:02:04,639

anyway if you're looking for short

3179

02:02:08,310 --> 02:02:05,920

helpful health tips

3180

02:02:09,669 --> 02:02:08,320

go to youtube and punch in health

3181

02:02:16,790 --> 02:02:09,679

matters now

3182

02:02:17,430 --> 02:02:16,800

log on to get the tea.com shop get

3183

02:02:19,750 --> 02:02:17,440

balanced

3184

02:02:20,470 --> 02:02:19,760

then learn some cool tips at health

3185

02:02:22,470 --> 02:02:20,480

matters

3186

02:02:24,950 --> 02:02:22,480

now you'll be glad you did that's get

3187

02:02:26,950 --> 02:02:24,960

the tea.com

3188

02:02:27,990 --> 02:02:26,960

your contact for current news and

3189

02:02:30,830 --> 02:02:28,000

trending topics

3190

02:02:33,189 --> 02:02:30,840

[Music]

3191

02:02:33,589 --> 02:02:33,199

kgraradio.com is jimmy church of fade to

3192

02:02:40,149 --> 02:02:33,599

black

3193

02:02:42,270 --> 02:02:40,159

coffee from river moon just click on the

3194

02:02:43,510 --> 02:02:42,280

river moon coffee banner at

3195

02:02:47,510 --> 02:02:43,520

jimmychurchradio.com

3196

02:02:50,629 --> 02:02:47,520

promo code f2b blend

3197

02:02:58,830 --> 02:02:50,639

this is the only way forward this

3198

02:02:58,840 --> 02:03:02,070

kgraradio.com

3199

02:03:05,189 --> 02:03:03,830

when you're in the house for longer

3200

02:03:07,510 --> 02:03:05,199

periods of time

3201

02:03:09,270 --> 02:03:07,520

you can see them flying or running

3202

02:03:12,310 --> 02:03:09,280

across the floor

3203

02:03:15,510 --> 02:03:12,320

ooh yuck they're unhealthy

3204

02:03:18,550 --> 02:03:15,520

gross and disgusting bugs i

3205

02:03:21,669 --> 02:03:18,560

loathe bugs we keep a clean home

3206

02:03:23,750 --> 02:03:21,679

but occasionally bugs show up well i

3207

02:03:24,550 --> 02:03:23,760

found something that is tougher than

3208

02:03:27,990 --> 02:03:24,560

bugs

3209

02:03:31,830 --> 02:03:28,000

orange guard on contact it kills hidden

3210

02:03:34,550 --> 02:03:31,840

bugs including ants roaches and fleas

3211

02:03:35,589 --> 02:03:34,560

plus orange guard is a residual

3212

02:03:37,669 --> 02:03:35,599

repellent

3213

02:03:38,870 --> 02:03:37,679

all of the ingredients of orange guard

3214

02:03:41,910 --> 02:03:38,880

are on the fda

3215

02:03:43,270 --> 02:03:41,920

generally recognized as safe list orange

3216

02:03:47,270 --> 02:03:43,280

guard may be used around

3217

02:03:49,589 --> 02:03:47,280

food humans and pets it comes with a 30

3218

02:03:52,189 --> 02:03:49,599

day money back guarantee

3219

02:03:53,669 --> 02:03:52,199

orange guard available at

3220

02:04:04,040 --> 02:03:53,679

orangeguard.com

3221

02:04:10,069 --> 02:04:06,870

[Applause]

3222

02:04:13,910 --> 02:04:10,079

you want to know a secret i love

3223

02:04:15,750 --> 02:04:13,920

ponies i really love ponies i'm serious

3224

02:04:17,510 --> 02:04:15,760

i couldn't stay sane without pawn

3225

02:04:20,709 --> 02:04:17,520

instabrush

3226

02:04:25,990 --> 02:04:20,719

why fade to black because you never got

3227

02:04:30,550 --> 02:04:28,229

this is fade to black with jimmy church

3228

02:04:46,709 --> 02:04:30,560

on the game changer radio network

3229

02:04:49,910 --> 02:04:48,229

welcome back painted black i'm your host

3230

02:04:52,950 --> 02:04:49,920

jimmy church what a great show tonight

3231

02:04:54,870 --> 02:04:52,960

isaac arthur the best

3232

02:04:56,310 --> 02:04:54,880

let everybody know i watch isaac walk

3233

02:04:58,790 --> 02:04:56,320

out

3234

02:05:01,589 --> 02:04:58,800

got another cup of coffee that's what

3235

02:05:03,350 --> 02:05:01,599

i'm talking about

3236

02:05:05,589 --> 02:05:03,360

it's so great when you're on the show

3237

02:05:08,709 --> 02:05:05,599

and i am able to just

3238

02:05:09,830 --> 02:05:08,719

uh have these conversations and and

3239

02:05:13,589 --> 02:05:09,840

isaac i'm serious

3240

02:05:17,030 --> 02:05:13,599

i i study this every night i am

3241

02:05:19,270 --> 02:05:17,040

listening and reading uh everything that

3242

02:05:23,030 --> 02:05:19,280

i can get my hands on and all i

3243

02:05:25,910 --> 02:05:23,040

do is build up questions

3244

02:05:26,390 --> 02:05:25,920

and and you're my guy right and and i

3245

02:05:29,669 --> 02:05:26,400

have to

3246

02:05:32,390 --> 02:05:29,679

thank you

3247

02:05:34,950 --> 02:05:32,400

and is this fun for you to just you know

3248

02:05:37,189 --> 02:05:34,960

to be able to uh engage in a

3249

02:05:39,109 --> 02:05:37,199

conversation like this free form

3250

02:05:40,470 --> 02:05:39,119

oh yeah it's actually kind of nice is a

3251

02:05:41,350 --> 02:05:40,480

lot of times you're on like a sciencey

3252

02:05:43,030 --> 02:05:41,360

show they

3253

02:05:44,870 --> 02:05:43,040

already know the usual routine stuff to

3254

02:05:45,990 --> 02:05:44,880

go through so you tend to expect the

3255

02:05:46,950 --> 02:05:46,000

questions you always have something

3256

02:05:48,390 --> 02:05:46,960

completely out of left field

3257

02:05:50,390 --> 02:05:48,400

me yeah that's right that's what i'm

3258

02:05:51,030 --> 02:05:50,400

talking about always feeling that's what

3259

02:05:54,870 --> 02:05:51,040

how often

3260

02:05:58,790 --> 02:05:54,880

i have no idea now

3261

02:06:01,990 --> 02:05:58,800

um i think it's safe to say uh uh

3262

02:06:05,109 --> 02:06:02,000

i have been looking into the

3263

02:06:06,790 --> 02:06:05,119

fermi paradox now for for

3264

02:06:11,510 --> 02:06:06,800

all of just about all of my life

3265

02:06:15,109 --> 02:06:13,990

when did you first get exposed to the

3266

02:06:18,229 --> 02:06:15,119

fermi paradox

3267

02:06:19,910 --> 02:06:18,239

was it because of enrico or did it did

3268

02:06:23,189 --> 02:06:19,920

it happen after that

3269

02:06:24,790 --> 02:06:23,199

oh i star trek

3270

02:06:26,709 --> 02:06:24,800

probably star trek or doctor who that

3271

02:06:28,629 --> 02:06:26,719

would be my first exposure to it

3272

02:06:31,350 --> 02:06:28,639

i didn't know the term for me paradox

3273

02:06:32,870 --> 02:06:31,360

probably until 2000 or so

3274

02:06:34,709 --> 02:06:32,880

i don't know if it was really as much

3275

02:06:36,310 --> 02:06:34,719

usage popularly at the time but

3276

02:06:37,750 --> 02:06:36,320

you know it's the the classic question

3277

02:06:39,910 --> 02:06:37,760

of where all the aliens are and

3278

02:06:41,030 --> 02:06:39,920

you'd like x-files winston so star trek

3279

02:06:42,550 --> 02:06:41,040

or doctor who

3280

02:06:44,470 --> 02:06:42,560

i kind of grew up on that stuff so it

3281

02:06:44,870 --> 02:06:44,480

was kind of one of those always a

3282

02:06:46,790 --> 02:06:44,880

question

3283

02:06:48,390 --> 02:06:46,800

it was really if you were in the sci-fi

3284

02:06:50,229 --> 02:06:48,400

it wasn't a question of

3285

02:06:51,750 --> 02:06:50,239

are there aliens it was a question of

3286

02:06:53,510 --> 02:06:51,760

where are they

3287

02:06:55,189 --> 02:06:53,520

and even today i tend to be on the

3288

02:06:56,950 --> 02:06:55,199

extreme skeptic side of

3289

02:06:58,870 --> 02:06:56,960

where we're having alien visitations but

3290

02:07:01,510 --> 02:06:58,880

i still assume they exist somewhere

3291

02:07:02,870 --> 02:07:01,520

it's just such a big place and the

3292

02:07:04,950 --> 02:07:02,880

question for me is always

3293

02:07:06,310 --> 02:07:04,960

are they anywhere close enough to us in

3294

02:07:07,910 --> 02:07:06,320

space and time that we could ever

3295

02:07:08,629 --> 02:07:07,920

actually have a chance to interact with

3296

02:07:11,270 --> 02:07:08,639

them

3297

02:07:13,030 --> 02:07:11,280

or are they just so far away that by the

3298

02:07:14,069 --> 02:07:13,040

time their life from their civilization

3299

02:07:15,430 --> 02:07:14,079

gets to us

3300

02:07:16,629 --> 02:07:15,440

you know the universe already expanded

3301
02:07:17,830 --> 02:07:16,639
them off the edge of cosmological

3302
02:07:20,629 --> 02:07:17,840
horizon

3303
02:07:21,270 --> 02:07:20,639
and you know i have to say these days i

3304
02:07:22,870 --> 02:07:21,280
tend to

3305
02:07:24,950 --> 02:07:22,880
probably be more that direction but i

3306
02:07:28,149 --> 02:07:24,960
still assume they're out there

3307
02:07:28,709 --> 02:07:28,159
well you have to and if you think about

3308
02:07:31,990 --> 02:07:28,719
it

3309
02:07:36,390 --> 02:07:32,000
uh how long has future

3310
02:07:42,709 --> 02:07:36,400
science been running

3311
02:07:46,229 --> 02:07:44,470
uh yeah but i mean it wasn't really a

3312
02:07:47,270 --> 02:07:46,239
full-blown weekly show in the first

3313
02:07:49,270 --> 02:07:47,280

couple years though

3314

02:07:50,390 --> 02:07:49,280

right right right right okay but that's

3315

02:07:54,229 --> 02:07:50,400

the number i need

3316

02:07:56,950 --> 02:07:54,239

see i'm gonna put together an equation

3317

02:07:58,870 --> 02:07:56,960

and i need to start there uh let's get

3318

02:08:01,430 --> 02:07:58,880

some position and velocity uh

3319

02:08:02,390 --> 02:08:01,440

going and and we'll get some mass as

3320

02:08:06,550 --> 02:08:02,400

well

3321

02:08:09,830 --> 02:08:06,560

is is this if you go back six years

3322

02:08:10,229 --> 02:08:09,840

and i'm pretty sure i am right if you go

3323

02:08:13,790 --> 02:08:10,239

back

3324

02:08:17,669 --> 02:08:13,800

six years there were only

3325

02:08:19,750 --> 02:08:17,679

500 exoplanets cataloged

3326

02:08:21,189 --> 02:08:19,760

okay it might have been over a thousand

3327

02:08:24,470 --> 02:08:21,199

by then but not but

3328

02:08:27,750 --> 02:08:24,480

let me finish all right because

3329

02:08:29,510 --> 02:08:27,760

today today like the

3330

02:08:31,589 --> 02:08:29,520

update from this month it's not the

3331

02:08:32,229 --> 02:08:31,599

catalog stars that number's about ten

3332

02:08:35,669 --> 02:08:32,239

thousand

3333

02:08:36,790 --> 02:08:35,679

there's four 000 that have been

3334

02:08:40,149 --> 02:08:36,800

discovered

3335

02:08:41,910 --> 02:08:40,159

they're waiting to catalogue them

3336

02:08:43,350 --> 02:08:41,920

um and then you have everything else

3337

02:08:44,629 --> 02:08:43,360

it's kind of like the expansion of the

3338

02:08:46,790 --> 02:08:44,639

universe there's news

3339

02:08:48,229 --> 02:08:46,800

you know there's new uh planets being

3340

02:08:51,430 --> 02:08:48,239

discovered every single day

3341

02:08:54,550 --> 02:08:51,440

and and and now the numbers are

3342

02:08:57,030 --> 02:08:54,560

so crazy because it's so simple uh to

3343

02:09:00,550 --> 02:08:57,040

discover these exoplanets

3344

02:09:03,189 --> 02:09:00,560

that's the confirmed but now it is

3345

02:09:04,629 --> 02:09:03,199

generally accepted i loved it when this

3346

02:09:08,069 --> 02:09:04,639

news broke

3347

02:09:13,189 --> 02:09:08,079

that every star in our

3348

02:09:16,709 --> 02:09:13,199

galaxy has at least one planet

3349

02:09:19,910 --> 02:09:16,719

that's a crazy number and that the

3350

02:09:20,790 --> 02:09:19,920

rocky planets in our milky way that

3351

02:09:23,910 --> 02:09:20,800
number

3352

02:09:26,950 --> 02:09:23,920
is somewhere between 10 and

3353

02:09:30,069 --> 02:09:26,960
20 billion

3354

02:09:32,709 --> 02:09:30,079
now at least at least at least right

3355

02:09:35,669 --> 02:09:32,719
now what does that do it doesn't change

3356

02:09:37,990 --> 02:09:35,679
the constant of the drake equation

3357

02:09:39,109 --> 02:09:38,000
right it doesn't but the numbers in the

3358

02:09:42,390 --> 02:09:39,119
drake equation

3359

02:09:43,350 --> 02:09:42,400
are now stupid yeah well i it to be fair

3360

02:09:45,030 --> 02:09:43,360
they always kind of

3361

02:09:46,950 --> 02:09:45,040
you know the drake's equation which kind

3362

02:09:48,229 --> 02:09:46,960
of formation rates planetary formation

3363

02:09:49,350 --> 02:09:48,239

things like that

3364

02:09:51,270 --> 02:09:49,360

there were always a lot of folks who

3365

02:09:52,550 --> 02:09:51,280

said it could be as high as one to one i

3366

02:09:53,910 --> 02:09:52,560

always took to the idea that it was at

3367

02:09:57,109 --> 02:09:53,920

least 10 percent

3368

02:09:58,790 --> 02:09:57,119

you know um but there was we didn't know

3369

02:10:00,870 --> 02:09:58,800

it could have been one a million

3370

02:10:02,390 --> 02:10:00,880

because then it was well then it was

3371

02:10:04,870 --> 02:10:02,400

zero exoplanets

3372

02:10:06,069 --> 02:10:04,880

yeah and everything was a guess i think

3373

02:10:07,510 --> 02:10:06,079

our first one i can't believe we

3374

02:10:08,550 --> 02:10:07,520

discovered the first exoplanet in the

3375

02:10:11,830 --> 02:10:08,560

late 90s

3376

02:10:13,589 --> 02:10:11,840

2000s 1995 1995.

3377

02:10:15,030 --> 02:10:13,599

and since then we found so many more and

3378

02:10:15,910 --> 02:10:15,040

again we knew there'd be a ton but we

3379

02:10:19,189 --> 02:10:15,920

didn't know

3380

02:10:21,830 --> 02:10:19,199

is it 1 000 systems that's got a planet

3381

02:10:23,109 --> 02:10:21,840

that's earth-like is that one a billion

3382

02:10:26,629 --> 02:10:23,119

and now it looks like it's

3383

02:10:29,830 --> 02:10:26,639

everywhere just everywhere so

3384

02:10:34,550 --> 02:10:29,840

what do we what do we do with this when

3385

02:10:37,350 --> 02:10:34,560

uh uh the numbers go through the roof

3386

02:10:38,069 --> 02:10:37,360

and we're looking at the fermi paradox

3387

02:10:41,430 --> 02:10:38,079

where we

3388

02:10:45,030 --> 02:10:41,440

know obviously it's a numbers game

3389

02:10:48,310 --> 02:10:45,040

but there's got to be life

3390

02:10:51,750 --> 02:10:48,320

uh a lot of it just in our galaxy

3391

02:10:54,390 --> 02:10:51,760

but where are they and then we have

3392

02:10:55,270 --> 02:10:54,400

this all the chatter with the united

3393

02:10:58,470 --> 02:10:55,280

states navy

3394

02:11:02,310 --> 02:10:58,480

the pentagon uaps videos

3395

02:11:05,430 --> 02:11:02,320

pilot testimony tic tacs visitation

3396

02:11:07,189 --> 02:11:05,440

yeah the new uh the new uap

3397

02:11:09,189 --> 02:11:07,199

created by the senate intelligence

3398

02:11:11,030 --> 02:11:09,199

committee that is now positioned in the

3399

02:11:13,109 --> 02:11:11,040

pentagon we've got a report due from

3400

02:11:16,550 --> 02:11:13,119

them in 180 days

3401

02:11:20,069 --> 02:11:16,560

um they are talking about this

3402

02:11:22,310 --> 02:11:20,079

in a whole other way um then

3403

02:11:23,990 --> 02:11:22,320

you as a skeptic which i understand

3404

02:11:25,350 --> 02:11:24,000

because you've never seen a ufo you've

3405

02:11:28,550 --> 02:11:25,360

never been abducted

3406

02:11:32,550 --> 02:11:28,560

you've never been probed you have it

3407

02:11:34,390 --> 02:11:32,560

that is so um but how does this start to

3408

02:11:35,189 --> 02:11:34,400

change the way that you are looking at

3409

02:11:37,750 --> 02:11:35,199

this

3410

02:11:38,709 --> 02:11:37,760

and what may be happening right now as

3411

02:11:41,750 --> 02:11:38,719

we speak

3412

02:11:43,350 --> 02:11:41,760

in the skies a frustrating

3413

02:11:44,870 --> 02:11:43,360

answer i always have to give people is i

3414

02:11:46,310 --> 02:11:44,880

i don't let it change my view on it

3415

02:11:47,350 --> 02:11:46,320

because i have to hold it to a certain

3416

02:11:49,030 --> 02:11:47,360

standard

3417

02:11:50,950 --> 02:11:49,040

um it has to be at that level where i

3418

02:11:53,830 --> 02:11:50,960

can say from a science perspective

3419

02:11:55,109 --> 02:11:53,840

yep absolutely this specific thing is an

3420

02:11:56,310 --> 02:11:55,119

alien of this variety

3421

02:11:57,750 --> 02:11:56,320

it's not enough just know that it's

3422

02:11:58,629 --> 02:11:57,760

undetected either or that it's

3423

02:12:00,790 --> 02:11:58,639

unidentified

3424

02:12:03,030 --> 02:12:00,800

i need to know what is it not just what

3425

02:12:04,629 --> 02:12:03,040

it isn't or what it might be

3426

02:12:05,990 --> 02:12:04,639

but as to what it is oh yeah it's

3427

02:12:07,270 --> 02:12:06,000

strange stuff you know i don't look at

3428

02:12:07,830 --> 02:12:07,280

the go fast videos and things like that

3429

02:12:09,189 --> 02:12:07,840

and say

3430

02:12:10,629 --> 02:12:09,199

oh yeah that's definitely a weather

3431

02:12:11,830 --> 02:12:10,639

balloon well it might be in that case

3432

02:12:13,270 --> 02:12:11,840

but you know

3433

02:12:14,950 --> 02:12:13,280

it's a weird place we live in the

3434

02:12:16,310 --> 02:12:14,960

universe is strange and

3435

02:12:18,310 --> 02:12:16,320

the idea that there is an alien life

3436

02:12:19,189 --> 02:12:18,320

somewhere in it is one of those things

3437

02:12:20,629 --> 02:12:19,199

that come to me more in

3438

02:12:22,470 --> 02:12:20,639

later or that i've gotten skeptical

3439

02:12:24,229 --> 02:12:22,480

about at all i tended to assume it was

3440

02:12:27,030 --> 02:12:24,239

pretty common when i was younger

3441

02:12:28,229 --> 02:12:27,040

um but uh we are getting to the point

3442

02:12:29,430 --> 02:12:28,239

where we are going to start making real

3443

02:12:31,589 --> 02:12:29,440

observations soon

3444

02:12:33,109 --> 02:12:31,599

i had a fun occasion to guest lecture at

3445

02:12:34,390 --> 02:12:33,119

the air force academy a couple months

3446

02:12:35,910 --> 02:12:34,400

back and

3447

02:12:37,510 --> 02:12:35,920

um you know they're good to the folks

3448

02:12:39,189 --> 02:12:37,520

who are going to be forming the space

3449

02:12:40,390 --> 02:12:39,199

force the young cadets they're looking

3450

02:12:41,910 --> 02:12:40,400

to go into that

3451

02:12:43,430 --> 02:12:41,920

and that is something that's on their

3452

02:12:45,830 --> 02:12:43,440

mind too so

3453

02:12:47,270 --> 02:12:45,840

you know we are if it's there we are

3454

02:12:48,470 --> 02:12:47,280

going to find it in the next couple

3455

02:12:50,550 --> 02:12:48,480

decades if it's there

3456

02:12:52,470 --> 02:12:50,560

it's actually actively with us that we

3457

02:12:54,229 --> 02:12:52,480

in my mind there's no doubt that if it's

3458

02:12:55,750 --> 02:12:54,239

out there and it's active that way near

3459

02:12:57,189 --> 02:12:55,760

us we'll have it pinned down

3460

02:12:59,109 --> 02:12:57,199

i tend to assume that we won't because

3461

02:13:00,310 --> 02:12:59,119

it isn't going on but we'll see

3462

02:13:01,750 --> 02:13:00,320

and that's one of those ones where i

3463

02:13:02,709 --> 02:13:01,760

won't mind being wrong if i try to be

3464

02:13:04,390 --> 02:13:02,719

wrong

3465

02:13:06,470 --> 02:13:04,400

but at the same time we do want to be

3466

02:13:07,750 --> 02:13:06,480

careful because the core of the ferry

3467

02:13:08,709 --> 02:13:07,760

paradox is the assumption that the

3468

02:13:10,790 --> 02:13:08,719

universe is such an

3469

02:13:12,310 --> 02:13:10,800

old and huge place that they must have

3470

02:13:14,550 --> 02:13:12,320

other intelligent life

3471

02:13:16,390 --> 02:13:14,560

well the earth is an old and huge place

3472

02:13:17,589 --> 02:13:16,400

and we're the first really intelligent

3473

02:13:20,390 --> 02:13:17,599

live on it

3474

02:13:22,069 --> 02:13:20,400

and we'll relate to the other stuff um

3475

02:13:23,669 --> 02:13:22,079

we don't know what the odds of life are

3476

02:13:25,430 --> 02:13:23,679

we have no idea what it takes to

3477

02:13:27,270 --> 02:13:25,440

actually cause life to exist

3478

02:13:29,189 --> 02:13:27,280

it is possible that that basic

3479

02:13:31,510 --> 02:13:29,199

abiogenesis event

3480

02:13:32,790 --> 02:13:31,520

is something that is less likely not to

3481

02:13:35,350 --> 02:13:32,800

happen even once

3482

02:13:36,390 --> 02:13:35,360

in the history of the entire universe uh

3483

02:13:37,669 --> 02:13:36,400

or it could be something that's so

3484

02:13:39,510 --> 02:13:37,679

common that it would happen on any

3485

02:13:40,550 --> 02:13:39,520

planet within a few years of that planet

3486

02:13:42,550 --> 02:13:40,560

forming

3487

02:13:43,830 --> 02:13:42,560

until we know these numbers until we can

3488

02:13:45,430 --> 02:13:43,840

actually get out there and observe it we

3489

02:13:46,310 --> 02:13:45,440

just don't know and so

3490

02:13:48,069 --> 02:13:46,320

you know as well as things whether

3491

02:13:48,629 --> 02:13:48,079

you're a skeptic or you're on board with

3492

02:13:51,669 --> 02:13:48,639

it

3493

02:13:52,229 --> 02:13:51,679

we all agree go find out go get more

3494

02:13:55,430 --> 02:13:52,239

data

3495

02:13:56,830 --> 02:13:55,440

go look and explore and uh we'll know

3496

02:14:00,229 --> 02:13:56,840

better then

3497

02:14:05,030 --> 02:14:00,239

wow no one knows for sure yet

3498

02:14:08,149 --> 02:14:05,040

you have written and presented

3499

02:14:11,430 --> 02:14:08,159

every possible angle of not only

3500

02:14:13,750 --> 02:14:11,440

populating uh the outer planets in our

3501

02:14:17,109 --> 02:14:13,760

solar system how we would do that

3502

02:14:20,910 --> 02:14:17,119

to colonizing the stars colonizing

3503

02:14:24,790 --> 02:14:20,920

uh with uh spaceships and of course

3504

02:14:28,069 --> 02:14:24,800

interplanetary intergalactical trade

3505

02:14:31,189 --> 02:14:28,079

uh all of every single angle

3506

02:14:33,669 --> 02:14:31,199

of alien e.t uh

3507

02:14:35,350 --> 02:14:33,679

intelligence and trade and life has been

3508

02:14:38,310 --> 02:14:35,360

explored by you

3509

02:14:40,229 --> 02:14:38,320

this is it you have presented some of

3510

02:14:44,149 --> 02:14:40,239

the most fascinating concepts

3511

02:14:46,069 --> 02:14:44,159

with this but yet you think that there's

3512

02:14:47,510 --> 02:14:46,079

a possibility we are alone in the

3513

02:14:52,069 --> 02:14:47,520

universe

3514

02:14:54,470 --> 02:14:52,079

are you a walking paradox yes

3515

02:14:56,390 --> 02:14:54,480

the fermi paradox is called that for a

3516

02:14:57,990 --> 02:14:56,400

reason it seems

3517

02:14:59,750 --> 02:14:58,000

so clear that it should be one or the

3518

02:15:01,510 --> 02:14:59,760

other but every solution i've seen for

3519

02:15:02,149 --> 02:15:01,520

the fermi paradox even when i subscribe

3520

02:15:03,830 --> 02:15:02,159

to

3521

02:15:05,830 --> 02:15:03,840

it's not a question of which one is the

3522

02:15:08,870 --> 02:15:05,840

best answer which one's the

3523

02:15:10,069 --> 02:15:08,880

least bad one you know because again it

3524

02:15:11,669 --> 02:15:10,079

doesn't make sense that we should be

3525

02:15:12,790 --> 02:15:11,679

alone in the universe that's not to me a

3526

02:15:15,270 --> 02:15:12,800

really good answer

3527

02:15:16,149 --> 02:15:15,280

to me it seems like the least bad one

3528

02:15:17,510 --> 02:15:16,159

you know uh

3529

02:15:19,430 --> 02:15:17,520

from the what i see is the available

3530

02:15:20,870 --> 02:15:19,440

evidence no one's really put one

3531

02:15:22,870 --> 02:15:20,880

together that has an absolutely good

3532

02:15:24,550 --> 02:15:22,880

reason for why it is and mind you

3533

02:15:25,910 --> 02:15:24,560

it's not a question of well the answer

3534

02:15:26,950 --> 02:15:25,920

is they're here okay

3535

02:15:28,550 --> 02:15:26,960

let's assume for the moment they

3536

02:15:29,270 --> 02:15:28,560

actually are here that they are coming

3537

02:15:30,709 --> 02:15:29,280

by and

3538

02:15:32,390 --> 02:15:30,719

all the sightings are correct or at

3539

02:15:33,350 --> 02:15:32,400

least some of the sides are correct in a

3540

02:15:35,189 --> 02:15:33,360

specific way

3541

02:15:36,390 --> 02:15:35,199

what are they doing here we're not in

3542

02:15:38,390 --> 02:15:36,400

agreement on what those are there's a

3543

02:15:39,830 --> 02:15:38,400

lot of suggested ideas

3544

02:15:41,910 --> 02:15:39,840

when how many of them are there where

3545

02:15:43,910 --> 02:15:41,920

are they from why are they here

3546

02:15:46,470 --> 02:15:43,920

we don't know what's their purpose in

3547

02:15:48,790 --> 02:15:46,480

life why isn't the galaxy more populated

3548

02:15:50,470 --> 02:15:48,800

why aren't they dyson swarming every

3549

02:15:51,430 --> 02:15:50,480

star in the galaxy so that we can still

3550

02:15:53,669 --> 02:15:51,440

see cells

3551

02:15:55,189 --> 02:15:53,679

we don't know and however it comes back

3552

02:15:56,470 --> 02:15:55,199

to you is that one of our basic

3553

02:15:58,790 --> 02:15:56,480

assumptions about the universe

3554

02:16:00,470 --> 02:15:58,800

has to be about don't know which one it

3555

02:16:01,510 --> 02:16:00,480

is it could be more than one but

3556

02:16:03,990 --> 02:16:01,520

something we're doing when we look at

3557

02:16:05,350 --> 02:16:04,000

the universe has to be wrong maybe

3558

02:16:08,550 --> 02:16:05,360

it's that the laws of thermodynamics

3559

02:16:11,270 --> 02:16:08,560

aren't solid yes but that's exactly

3560

02:16:11,990 --> 02:16:11,280

now you're on the right track in that

3561

02:16:16,310 --> 02:16:12,000

how do we

3562

02:16:19,750 --> 02:16:16,320

even know what to look for

3563

02:16:23,350 --> 02:16:19,760

we are observing in our

3564

02:16:26,950 --> 02:16:23,360

speed in our frequency

3565

02:16:30,229 --> 02:16:26,960

we are looking for radio signals in our

3566

02:16:33,030 --> 02:16:30,239

speed they may be living on a whole

3567

02:16:34,230 --> 02:16:33,040

other time scale that is out of our

3568

02:16:37,589 --> 02:16:34,240

frequency range

3569

02:16:40,389 --> 02:16:37,599

all together it may not be observable

3570

02:16:42,469 --> 02:16:40,399

until they are here but looking out into

3571

02:16:44,790 --> 02:16:42,479

the stars

3572

02:16:46,870 --> 02:16:44,800

it's just not there it's noise that

3573

02:16:48,870 --> 02:16:46,880

we're seeing

3574

02:16:50,469 --> 02:16:48,880

we have exactly one example of life that

3575

02:16:51,509 --> 02:16:50,479

we've been able to study in detail

3576

02:16:53,750 --> 02:16:51,519

we don't know that it works that way

3577

02:16:55,270 --> 02:16:53,760

anywhere else but we but we have some

3578

02:16:56,549 --> 02:16:55,280

indications of what it might look like

3579

02:16:58,389 --> 02:16:56,559

for instance if we talk about

3580

02:17:00,309 --> 02:16:58,399

you know post chemo trans unix systems

3581

02:17:01,750 --> 02:17:00,319

we say well let's replace all the

3582

02:17:03,429 --> 02:17:01,760

neurons in people's heads which

3583

02:17:04,469 --> 02:17:03,439

communicate at like one millionth of the

3584

02:17:06,150 --> 02:17:04,479

speed of light with something that

3585

02:17:07,669 --> 02:17:06,160

communicates at the speed of light

3586

02:17:09,589 --> 02:17:07,679

and now a sudden sometimes thinking a

3587

02:17:10,870 --> 02:17:09,599

million times faster

3588

02:17:12,389 --> 02:17:10,880

well if they're thinking a million times

3589

02:17:13,990 --> 02:17:12,399

faster they're experiencing existence a

3590

02:17:16,389 --> 02:17:14,000

million times faster

3591

02:17:17,990 --> 02:17:16,399

so um you know the speed of light would

3592

02:17:19,190 --> 02:17:18,000

be quite a problem for them because then

3593

02:17:20,870 --> 02:17:19,200

it's not taking four

3594

02:17:22,709 --> 02:17:20,880

year light years to get there it feels

3595

02:17:25,349 --> 02:17:22,719

like four million light years

3596

02:17:25,910 --> 02:17:25,359

um they experience time so much faster

3597

02:17:28,230 --> 02:17:25,920

if this is

3598

02:17:30,309 --> 02:17:28,240

a a pathway that life would follow or

3599

02:17:32,870 --> 02:17:30,319

alternatively maybe life for them is

3600

02:17:33,509 --> 02:17:32,880

uh you know slow superconducting super

3601
02:17:37,750 --> 02:17:33,519
helium

3602
02:17:41,190 --> 02:17:37,760
past pluto

3603
02:17:43,589 --> 02:17:41,200
and life takes place in a time scale

3604
02:17:45,349 --> 02:17:43,599
that makes tree lifetimes go really slow

3605
02:17:46,150 --> 02:17:45,359
or they observe mountains going slow and

3606
02:17:48,709 --> 02:17:46,160
for them

3607
02:17:50,230 --> 02:17:48,719
life only started a few minutes ago in

3608
02:17:51,910 --> 02:17:50,240
personal time

3609
02:17:54,150 --> 02:17:51,920
we just don't know because we have you

3610
02:17:55,429 --> 02:17:54,160
know a whole scientific example of what

3611
02:17:58,629 --> 02:17:55,439
intelligent life

3612
02:17:59,990 --> 02:17:58,639
is like is a sample size of one

3613
02:18:01,509 --> 02:18:00,000

[Music]

3614

02:18:04,469 --> 02:18:01,519

and we might be a regular example we

3615

02:18:07,750 --> 02:18:04,479

might be a weird one so

3616

02:18:11,270 --> 02:18:07,760

we and to understand this concept

3617

02:18:14,549 --> 02:18:11,280

uh and to digest it

3618

02:18:15,509 --> 02:18:14,559

we are looking with telescopes out of

3619

02:18:19,270 --> 02:18:15,519

the stars

3620

02:18:23,669 --> 02:18:19,280

and no matter how far away

3621

02:18:26,870 --> 02:18:23,679

you go 12 light years away well

3622

02:18:29,589 --> 02:18:26,880

we are observing the old

3623

02:18:30,070 --> 02:18:29,599

version of that we are not looking at

3624

02:18:34,150 --> 02:18:30,080

them

3625

02:18:37,349 --> 02:18:34,160

in real time also it's the same

3626

02:18:40,950 --> 02:18:37,359

observation for them looking at us

3627

02:18:41,910 --> 02:18:40,960

from 12 light years away what is here on

3628

02:18:45,110 --> 02:18:41,920

earth

3629

02:18:47,990 --> 02:18:45,120

astronomy is history right right

3630

02:18:49,349 --> 02:18:48,000

right so if we are looking at the old

3631

02:18:52,950 --> 02:18:49,359

version

3632

02:18:56,549 --> 02:18:52,960

then life could have advanced

3633

02:18:57,270 --> 02:18:56,559

right 50 million years ago but we don't

3634

02:19:00,389 --> 02:18:57,280

see it

3635

02:19:03,830 --> 02:19:00,399

yet and we wouldn't know it yet

3636

02:19:05,509 --> 02:19:03,840

if we are just observing if the

3637

02:19:06,790 --> 02:19:05,519

the u.s place that life exists at on

3638

02:19:08,230 --> 02:19:06,800

intelligent life exists at is the

3639

02:19:09,509 --> 02:19:08,240

andromeda galaxy then

3640

02:19:11,110 --> 02:19:09,519

it would only have to have developed the

3641

02:19:12,150 --> 02:19:11,120

last two million years to be invisible

3642

02:19:14,230 --> 02:19:12,160

to us

3643

02:19:15,830 --> 02:19:14,240

uh and vice versa you know and that's

3644

02:19:17,589 --> 02:19:15,840

the nearest galaxy

3645

02:19:19,509 --> 02:19:17,599

but for our own galaxy everything's

3646

02:19:21,110 --> 02:19:19,519

within a hundred thousand years or so

3647

02:19:22,790 --> 02:19:21,120

that starts getting the time zone with

3648

02:19:24,230 --> 02:19:22,800

the universe being as as old as it is

3649

02:19:26,070 --> 02:19:24,240

you'd expect that if there's a lot of

3650

02:19:27,349 --> 02:19:26,080

civilizations here

3651

02:19:29,030 --> 02:19:27,359

one of them should still be around that

3652

02:19:30,230 --> 02:19:29,040

we could communicate with or see

3653

02:19:31,589 --> 02:19:30,240

especially if they actually were getting

3654

02:19:32,389 --> 02:19:31,599

out there and colonizing but then again

3655

02:19:34,309 --> 02:19:32,399

that as soon as they

3656

02:19:35,990 --> 02:19:34,319

they go out and colonize the universe

3657

02:19:37,589 --> 02:19:36,000

maybe they don't maybe they go out and

3658

02:19:39,110 --> 02:19:37,599

colonize the multiverse

3659

02:19:40,870 --> 02:19:39,120

it's a lot easier if you have the

3660

02:19:42,950 --> 02:19:40,880

technology for an ability to do it to go

3661

02:19:44,870 --> 02:19:42,960

colonize a parallel copy of earth

3662

02:19:47,750 --> 02:19:44,880

that's exactly identical except the

3663

02:19:49,270 --> 02:19:47,760

first intelligent primate uh you know

3664

02:19:50,950 --> 02:19:49,280

hominid fellow were dead and never

3665

02:19:52,230 --> 02:19:50,960

evolved or at least would not for

3666

02:19:54,469 --> 02:19:52,240

another 10 million years

3667

02:19:55,910 --> 02:19:54,479

you go colonize the nearly infinite

3668

02:19:57,429 --> 02:19:55,920

numbers of copies of earth that are

3669

02:19:58,790 --> 02:19:57,439

identical except they don't have humans

3670

02:20:00,230 --> 02:19:58,800

on them

3671

02:20:01,910 --> 02:20:00,240

there should be a new infant supply

3672

02:20:03,510 --> 02:20:01,920

those at the theory is right

3673

02:20:05,110 --> 02:20:03,520

see that technology you get that before

3674

02:20:06,790 --> 02:20:05,120

your first starships have arrived the

3675

02:20:09,270 --> 02:20:06,800

nearest colonies

3676

02:20:10,389 --> 02:20:09,280

why are you calling out the galaxy if

3677

02:20:13,510 --> 02:20:10,399

the cop is your own water

3678

02:20:15,349 --> 02:20:13,520

aren't we looking to do the same thing

3679

02:20:18,389 --> 02:20:15,359

we don't want to colonize a planet

3680

02:20:19,990 --> 02:20:18,399

that's already got life on it

3681

02:20:21,270 --> 02:20:20,000

as a copy of your own planet you'll go

3682

02:20:23,349 --> 02:20:21,280

find one with the dinosaurs that's still

3683

02:20:25,030 --> 02:20:23,359

around that you enjoy or you know again

3684

02:20:26,309 --> 02:20:25,040

why go travel to a distant world that

3685

02:20:27,270 --> 02:20:26,319

you don't even know there's life on it

3686

02:20:29,110 --> 02:20:27,280

yet

3687

02:20:30,950 --> 02:20:29,120

except to explore now to be fair if you

3688

02:20:32,309 --> 02:20:30,960

can do that if you can access all these

3689

02:20:33,190 --> 02:20:32,319

multiverse copies of your own word

3690

02:20:35,270 --> 02:20:33,200

colonize

3691

02:20:36,309 --> 02:20:35,280

that gives you access to so much

3692

02:20:37,349 --> 02:20:36,319

resources

3693

02:20:38,710 --> 02:20:37,359

that you shouldn't have any problem

3694

02:20:39,830 --> 02:20:38,720

going out and exploring the galaxy just

3695

02:20:41,349 --> 02:20:39,840

for kicks

3696

02:20:43,190 --> 02:20:41,359

of course that brings up the question of

3697

02:20:44,630 --> 02:20:43,200

which galaxy you're exploring since you

3698

02:20:46,150 --> 02:20:44,640

presume you have access to an infinite

3699

02:20:48,790 --> 02:20:46,160

supply they'll go look at

3700

02:20:50,389 --> 02:20:48,800

so it is one of those things where there

3701

02:20:51,830 --> 02:20:50,399

is life around and it seems like there

3702

02:20:52,870 --> 02:20:51,840

should be it should be bumping into each

3703

02:20:56,950 --> 02:20:52,880

other all over the place

3704

02:20:59,270 --> 02:20:56,960

do you think that we

3705

02:21:00,389 --> 02:20:59,280

i don't care about time scales here do

3706

02:21:03,910 --> 02:21:00,399

you think that we will

3707

02:21:07,750 --> 02:21:03,920

ever venture as earthlings

3708

02:21:10,070 --> 02:21:07,760

outside of our galaxy yes

3709

02:21:11,510 --> 02:21:10,080

really you think that's possible do you

3710

02:21:13,830 --> 02:21:11,520

think it is possible i i just

3711

02:21:15,110 --> 02:21:13,840

for a given value of earthlings because

3712

02:21:16,230 --> 02:21:15,120

if it takes you 200

3713

02:21:18,550 --> 02:21:16,240

000 years to get to the edge of the

3714

02:21:21,030 --> 02:21:18,560

galaxy you know again

3715

02:21:22,150 --> 02:21:21,040

that's a long time for civilization

3716

02:21:24,070 --> 02:21:22,160

that's 50

3717

02:21:25,510 --> 02:21:24,080

times longer than spencer's the pm it's

3718

02:21:28,550 --> 02:21:25,520

built or since

3719

02:21:30,630 --> 02:21:28,560

uh you know the babylon first got built

3720

02:21:31,590 --> 02:21:30,640

you know it's a long time at the same

3721

02:21:32,870 --> 02:21:31,600

time

3722

02:21:33,910 --> 02:21:32,880

galaxy and that's if you're traveling

3723

02:21:35,349 --> 02:21:33,920

the speed of light that's if you're

3724

02:21:35,910 --> 02:21:35,359

traveling at the speed of light most

3725

02:21:38,150 --> 02:21:35,920

people don't

3726
02:21:39,990 --> 02:21:38,160
understand the size of the milky way you

3727
02:21:43,910 --> 02:21:40,000
know it's 150 to 200

3728
02:21:46,469 --> 02:21:43,920
000 light years across that's ginormous

3729
02:21:47,190 --> 02:21:46,479
and so for us and where we are in the

3730
02:21:48,950 --> 02:21:47,200
spiral

3731
02:21:50,630 --> 02:21:48,960
we're kind of you know we're in the

3732
02:21:53,349 --> 02:21:50,640
goldilocks zone of

3733
02:21:54,309 --> 02:21:53,359
of the galaxy right okay there are

3734
02:21:57,590 --> 02:21:54,319
violent

3735
02:21:59,990 --> 02:21:57,600
places in our galaxy with radiation

3736
02:22:01,670 --> 02:22:00,000
where there is no life on any planet it

3737
02:22:04,070 --> 02:22:01,680
is it's an impossibility

3738
02:22:05,510 --> 02:22:04,080

to do this statement generally is uh the

3739

02:22:06,950 --> 02:22:05,520

you know the space is very empty it's

3740

02:22:08,469 --> 02:22:06,960

like well no space isn't

3741

02:22:10,309 --> 02:22:08,479

empty it's just everything it's full of

3742

02:22:13,349 --> 02:22:10,319

is horribly deadly

3743

02:22:15,030 --> 02:22:13,359

horribly deadly um but where we are

3744

02:22:17,110 --> 02:22:15,040

we're at the edge of the galaxy and it

3745

02:22:20,550 --> 02:22:17,120

would still take us forever

3746

02:22:23,190 --> 02:22:20,560

uh to not only get to uh the next star

3747

02:22:25,429 --> 02:22:23,200

but to get outside of the galaxy or even

3748

02:22:27,429 --> 02:22:25,439

remotely close to andromeda which is our

3749

02:22:29,750 --> 02:22:27,439

closest galactic neighbor

3750

02:22:30,710 --> 02:22:29,760

right i think i did uh an episode that

3751

02:22:32,550 --> 02:22:30,720

was looking at that

3752

02:22:34,230 --> 02:22:32,560

idea life in a space colony series i was

3753

02:22:34,950 --> 02:22:34,240

traveling out the edge of the galaxy and

3754

02:22:36,389 --> 02:22:34,960

uh

3755

02:22:37,670 --> 02:22:36,399

intergalactic colonization they get to

3756

02:22:38,150 --> 02:22:37,680

the tournament system they're trying to

3757

02:22:39,830 --> 02:22:38,160

say

3758

02:22:41,270 --> 02:22:39,840

how are we going to get to another stone

3759

02:22:43,110 --> 02:22:41,280

you know to another galaxy

3760

02:22:44,469 --> 02:22:43,120

and you'll embrace here two million year

3761

02:22:45,830 --> 02:22:44,479

journey even if you get yourself into

3762

02:22:48,070 --> 02:22:45,840

neolight speed

3763

02:22:49,270 --> 02:22:48,080

and there is stuff between there the

3764

02:22:50,550 --> 02:22:49,280

idea that there isn't anything between

3765

02:22:52,309 --> 02:22:50,560

us there's probably about half the stars

3766

02:22:53,349 --> 02:22:52,319

in the universe all outside of galaxies

3767

02:22:54,870 --> 02:22:53,359

there's a lot of them out there but

3768

02:22:56,469 --> 02:22:54,880

they're so thinly spread they'll bring

3769

02:22:57,670 --> 02:22:56,479

the highest oasis thousands light years

3770

02:23:01,190 --> 02:22:57,680

from each other

3771

02:23:02,870 --> 02:23:01,200

and uh that's a long journey but

3772

02:23:04,309 --> 02:23:02,880

you know it's it's not the question of

3773

02:23:04,870 --> 02:23:04,319

whether or not you're going to go there

3774

02:23:06,469 --> 02:23:04,880

yourself

3775

02:23:08,070 --> 02:23:06,479

on these planned missions it's the idea

3776

02:23:08,870 --> 02:23:08,080

that if i've got some tribe that's

3777

02:23:11,670 --> 02:23:08,880

sitting in

3778

02:23:13,270 --> 02:23:11,680

in ethiopia they're not contemplating

3779

02:23:15,590 --> 02:23:13,280

going out and colonizing

3780

02:23:17,270 --> 02:23:15,600

siberia or the americas they're just

3781

02:23:18,070 --> 02:23:17,280

going the next town over and their kids

3782

02:23:19,830 --> 02:23:18,080

feel one more

3783

02:23:21,110 --> 02:23:19,840

and their kids go one more it doesn't

3784

02:23:22,950 --> 02:23:21,120

have to be organized

3785

02:23:24,950 --> 02:23:22,960

if there is territory out there and

3786

02:23:26,550 --> 02:23:24,960

people have a motivation go to it they

3787

02:23:28,150 --> 02:23:26,560

will eventually do so

3788

02:23:30,150 --> 02:23:28,160

so it just comes down the question is is

3789

02:23:31,830 --> 02:23:30,160

there a motivation to do so

3790

02:23:33,190 --> 02:23:31,840

and of course that is based on the

3791

02:23:34,870 --> 02:23:33,200

assumption there's a finite amount of

3792

02:23:36,070 --> 02:23:34,880

matter and energy they have access to

3793

02:23:38,150 --> 02:23:36,080

we don't know what technologies we're

3794

02:23:39,990 --> 02:23:38,160

going to find in another 10 years 20

3795

02:23:41,349 --> 02:23:40,000

years 10 million years

3796

02:23:42,950 --> 02:23:41,359

it might be that by the time they get to

3797

02:23:44,309 --> 02:23:42,960

the edge of the galaxy there's no reason

3798

02:23:45,110 --> 02:23:44,319

for them to leave it because they got

3799

02:23:47,349 --> 02:23:45,120

better

3800

02:23:48,630 --> 02:23:47,359

places to go but they might do it anyway

3801
02:23:50,389 --> 02:23:48,640
just because if you got access to all

3802
02:23:52,790 --> 02:23:50,399
those better resources

3803
02:23:53,429 --> 02:23:52,800
it makes it easier to make that journey

3804
02:23:56,630 --> 02:23:53,439
so

3805
02:23:58,710 --> 02:23:56,640
now we are sending probes to

3806
02:24:00,150 --> 02:23:58,720
saturn and jupiter and the moon and

3807
02:24:03,429 --> 02:24:00,160
venus and mars

3808
02:24:06,550 --> 02:24:03,439
and and uh just did the fantastic

3809
02:24:09,830 --> 02:24:06,560
drive-by of uh pluto which was fantastic

3810
02:24:10,150 --> 02:24:09,840
so uh but we're not those are obviously

3811
02:24:13,670 --> 02:24:10,160
not

3812
02:24:16,630 --> 02:24:13,680
manned missions isn't that

3813
02:24:18,630 --> 02:24:16,640

what e.t would be doing it's not

3814

02:24:20,150 --> 02:24:18,640
necessarily with the ginormous

3815

02:24:22,710 --> 02:24:20,160
colonizing

3816

02:24:24,630 --> 02:24:22,720
uh starship but they would be sending

3817

02:24:27,429 --> 02:24:24,640
probes throughout the galaxy

3818

02:24:28,309 --> 02:24:27,439
to see what is out there sure but define

3819

02:24:30,389 --> 02:24:28,319
manned

3820

02:24:31,670 --> 02:24:30,399
probe you know well they talk about

3821

02:24:33,590 --> 02:24:31,680
something that's not a man it's an alien

3822

02:24:35,270 --> 02:24:33,600
but it might be an alien ai

3823

02:24:36,150 --> 02:24:35,280
well you know we are wondering if

3824

02:24:37,910 --> 02:24:36,160
there's going to be anything that really

3825

02:24:39,270 --> 02:24:37,920
qualifies as a classic human in another

3826

02:24:42,150 --> 02:24:39,280

couple centuries

3827

02:24:42,710 --> 02:24:42,160

um it might be that they are cyborgs

3828

02:24:45,429 --> 02:24:42,720

they might be

3829

02:24:47,110 --> 02:24:45,439

artificial intelligences uh and that's

3830

02:24:48,790 --> 02:24:47,120

to be a pretty blurry distinction anyway

3831

02:24:50,469 --> 02:24:48,800

what is artificial intelligence humans

3832

02:24:52,389 --> 02:24:50,479

are artificial intelligence that we're

3833

02:24:54,950 --> 02:24:52,399

about as a

3834

02:24:55,750 --> 02:24:54,960

um but uh will an alien that's coming

3835

02:24:58,230 --> 02:24:55,760

here

3836

02:24:59,510 --> 02:24:58,240

in a probe would that probe be dumb it

3837

02:25:01,750 --> 02:24:59,520

might be they might intentionally make

3838

02:25:03,590 --> 02:25:01,760

their probes as dumb as they need to be

3839

02:25:05,030 --> 02:25:03,600

just to get the mission done because

3840

02:25:06,469 --> 02:25:05,040

it's a little bit dangerous to send out

3841

02:25:07,429 --> 02:25:06,479

self-replicating probes in the universe

3842

02:25:09,590 --> 02:25:07,439

they are smart

3843

02:25:10,950 --> 02:25:09,600

they might come home for a visit yeah

3844

02:25:12,870 --> 02:25:10,960

but uh

3845

02:25:14,309 --> 02:25:12,880

you know they might be very smart popes

3846

02:25:15,670 --> 02:25:14,319

and there might be that

3847

02:25:17,190 --> 02:25:15,680

that is one way that they go out to

3848

02:25:18,870 --> 02:25:17,200

explore you also they send out a probe

3849

02:25:20,710 --> 02:25:18,880

that's got copies of their own minds on

3850

02:25:22,389 --> 02:25:20,720

them when they arrive they

3851
02:25:24,150 --> 02:25:22,399
unpack look around grab a random

3852
02:25:26,469 --> 02:25:24,160
asteroid set up shop and say

3853
02:25:27,990 --> 02:25:26,479
ah and there's life yo let's talk to it

3854
02:25:28,630 --> 02:25:28,000
or there's life here that's eradicated

3855
02:25:33,750 --> 02:25:28,640
or

3856
02:25:34,870 --> 02:25:33,760
we don't know what they do we can only

3857
02:25:38,150 --> 02:25:34,880
guess what we might do

3858
02:25:39,910 --> 02:25:38,160
well that's exactly if we base you know

3859
02:25:43,030 --> 02:25:39,920
what could be coming here

3860
02:25:44,790 --> 02:25:43,040
just on what what our interest is which

3861
02:25:46,389 --> 02:25:44,800
is sending probes out to all the planets

3862
02:25:47,750 --> 02:25:46,399
that we can and hoping that something's

3863
02:25:50,389 --> 02:25:47,760

going to land

3864

02:25:51,830 --> 02:25:50,399

uh right that's that's can't even say

3865

02:25:53,590 --> 02:25:51,840

with so indeed that they'd be curious

3866

02:25:54,790 --> 02:25:53,600

though that does seem likely

3867

02:25:57,270 --> 02:25:54,800

you shouldn't be a technological

3868

02:25:59,030 --> 02:25:57,280

civilization if you're not curious but

3869

02:26:00,469 --> 02:25:59,040

maybe they're not curious anymore maybe

3870

02:26:01,830 --> 02:26:00,479

curiosity is a

3871

02:26:03,510 --> 02:26:01,840

thing they've put out themselves as a

3872

02:26:04,630 --> 02:26:03,520

safety factor to avoid blowing

3873

02:26:06,630 --> 02:26:04,640

themselves up

3874

02:26:08,150 --> 02:26:06,640

but it does seem like the one thing we

3875

02:26:09,910 --> 02:26:08,160

could be reasonably talking about with

3876
02:26:11,510 --> 02:26:09,920
aliens is they should be curious about

3877
02:26:15,030 --> 02:26:11,520
the rest of the universe

3878
02:26:16,150 --> 02:26:15,040
so if if with your calculations i'm

3879
02:26:17,830 --> 02:26:16,160
looking at the clock you're going to

3880
02:26:19,349 --> 02:26:17,840
hang for overtime right

3881
02:26:21,349 --> 02:26:19,359
sure okay that's what i'm talking about

3882
02:26:23,190 --> 02:26:21,359
it's isaac arthur he's not going to say

3883
02:26:26,790 --> 02:26:23,200
no

3884
02:26:27,990 --> 02:26:26,800
what kind of uh time are we talking

3885
02:26:31,030 --> 02:26:28,000
about

3886
02:26:34,389 --> 02:26:31,040
once a civilization takes hold

3887
02:26:38,230 --> 02:26:34,399
and interstellar travel is available

3888
02:26:41,510 --> 02:26:38,240

to them then what are we talking about

3889

02:26:45,990 --> 02:26:41,520

once you colonize one planet

3890

02:26:49,030 --> 02:26:46,000

how quickly could you take over a galaxy

3891

02:26:52,469 --> 02:26:49,040

how fast your ships move it could be

3892

02:26:54,870 --> 02:26:52,479

it could literally be like that yeah

3893

02:26:56,230 --> 02:26:54,880

we could theoretically inside this next

3894

02:26:57,510 --> 02:26:56,240

century or two there's a couple of

3895

02:26:59,670 --> 02:26:57,520

technologies that we got in the next

3896

02:27:01,590 --> 02:26:59,680

century to would let us send out

3897

02:27:02,950 --> 02:27:01,600

ships as fast as we could breed up

3898

02:27:04,230 --> 02:27:02,960

populations to put them on them and if

3899

02:27:05,670 --> 02:27:04,240

we really want to might be able to clone

3900

02:27:07,590 --> 02:27:05,680

and replicate people to send

3901

02:27:09,270 --> 02:27:07,600

you know i could give you some scenarios

3902

02:27:11,349 --> 02:27:09,280

while we have the entire thing colonized

3903

02:27:13,429 --> 02:27:11,359

at 99 of lightspeed

3904

02:27:14,389 --> 02:27:13,439

that could rely on currently known

3905

02:27:16,309 --> 02:27:14,399

physics

3906

02:27:17,750 --> 02:27:16,319

i don't think we go quite that fast but

3907

02:27:18,790 --> 02:27:17,760

that's kind of the timeline you know

3908

02:27:21,030 --> 02:27:18,800

million years

3909

02:27:22,790 --> 02:27:21,040

maybe less the resources are there the

3910

02:27:25,110 --> 02:27:22,800

energy is there

3911

02:27:26,950 --> 02:27:25,120

right you can colonize the whole galaxy

3912

02:27:27,750 --> 02:27:26,960

with just the resources in this galaxy

3913

02:27:29,349 --> 02:27:27,760

without even getting into

3914

02:27:32,469 --> 02:27:29,359

self-replicating probes there's enough

3915

02:27:35,030 --> 02:27:32,479

in this solar system alone

3916

02:27:37,030 --> 02:27:35,040

back to the fermi paradox if that is the

3917

02:27:40,389 --> 02:27:37,040

case why haven't we seen it

3918

02:27:43,670 --> 02:27:40,399

and exactly okay so but

3919

02:27:49,830 --> 02:27:47,670

we could tomorrow destroy the planet

3920

02:27:51,990 --> 02:27:49,840

right nuclear exchange we're done it's

3921

02:27:54,630 --> 02:27:52,000

like we were never here

3922

02:27:55,910 --> 02:27:54,640

late filter options it's that that

3923

02:27:57,990 --> 02:27:55,920

filter

3924

02:27:58,950 --> 02:27:58,000

is is the one that fascinates me the

3925

02:28:03,030 --> 02:27:58,960

most

3926

02:28:04,550 --> 02:28:03,040

that even if uh a civilization makes it

3927

02:28:07,670 --> 02:28:04,560

to a million years

3928

02:28:09,590 --> 02:28:07,680

right of of technology right we're in a

3929

02:28:10,469 --> 02:28:09,600

hundred years of technology right now

3930

02:28:12,870 --> 02:28:10,479

that's where we are

3931

02:28:14,790 --> 02:28:12,880

at but if a civilization gets out there

3932

02:28:18,309 --> 02:28:14,800

they have to survive

3933

02:28:19,670 --> 02:28:18,319

killing each other right

3934

02:28:21,910 --> 02:28:19,680

well they're probably pretty talented at

3935

02:28:23,349 --> 02:28:21,920

about time they've gotten technology too

3936

02:28:24,950 --> 02:28:23,359

you know if you're going from basic

3937

02:28:26,469 --> 02:28:24,960

dolphinian perspective they probably

3938

02:28:27,349 --> 02:28:26,479

aren't the nicest people at war they

3939

02:28:29,349 --> 02:28:27,359

might be nice too

3940

02:28:30,710 --> 02:28:29,359

but there's a one that do we know two

3941

02:28:34,309 --> 02:28:30,720

things about aliens for certain

3942

02:28:36,950 --> 02:28:34,319

one they're not wimps they are not wimps

3943

02:28:37,670 --> 02:28:36,960

um they are going to know how to be

3944

02:28:40,070 --> 02:28:37,680

aggressive

3945

02:28:41,910 --> 02:28:40,080

and how to survive how to survive yes

3946

02:28:45,510 --> 02:28:41,920

and two they'll want to survive

3947

02:28:48,950 --> 02:28:47,349

they might be very benevolent but still

3948

02:28:49,750 --> 02:28:48,960

before themselves over us or they might

3949

02:28:51,190 --> 02:28:49,760

be

3950

02:28:52,389 --> 02:28:51,200

really set aside or like to go out and

3951

02:28:54,150 --> 02:28:52,399

kill anybody but they'll still value

3952

02:28:56,950 --> 02:28:54,160

their own existence overalls

3953

02:28:59,190 --> 02:28:56,960

well look we're pretty benevolent as a

3954

02:29:01,429 --> 02:28:59,200

species we kill each other a lot but

3955

02:29:02,870 --> 02:29:01,439

we're generally pretty nice you are the

3956

02:29:05,270 --> 02:29:02,880

most benevolent thing on the planet

3957

02:29:06,870 --> 02:29:05,280

yeah but when when we're walking around

3958

02:29:09,590 --> 02:29:06,880

our backyard

3959

02:29:09,910 --> 02:29:09,600

i'm not really conscious about stepping

3960

02:29:16,230 --> 02:29:09,920

on

3961

02:29:19,750 --> 02:29:16,240

right oh i'm so sorry

3962

02:29:22,950 --> 02:29:19,760

no it's just the way that it

3963

02:29:24,870 --> 02:29:22,960

is and if something is that advanced

3964

02:29:26,870 --> 02:29:24,880

up in front of us it's not about they

3965

02:29:28,790 --> 02:29:26,880

would look at us as ants

3966

02:29:30,790 --> 02:29:28,800

but they would definitely have a

3967

02:29:32,630 --> 02:29:30,800

different philosophical view

3968

02:29:34,389 --> 02:29:32,640

on themselves and their future and their

3969

02:29:35,910 --> 02:29:34,399

own survival

3970

02:29:37,590 --> 02:29:35,920

i think so and i mean we can say that

3971

02:29:39,030 --> 02:29:37,600

they would look on us as ants but that

3972

02:29:40,630 --> 02:29:39,040

is a flawed analogy

3973

02:29:42,150 --> 02:29:40,640

the smarter we've gotten the more we've

3974

02:29:45,030 --> 02:29:42,160

tended to think about

3975

02:29:45,910 --> 02:29:45,040

those things on the smaller scale um you

3976

02:29:47,349 --> 02:29:45,920

know we

3977

02:29:49,030 --> 02:29:47,359

i i won't go so far say that

3978

02:29:51,750 --> 02:29:49,040

intelligence breeds benevolence

3979

02:29:53,750 --> 02:29:51,760

it probably does not but it does breed a

3980

02:29:55,990 --> 02:29:53,760

higher conscience about what's going on

3981

02:29:57,429 --> 02:29:56,000

so i don't think they would think of us

3982

02:29:58,870 --> 02:29:57,439

as we think of ants

3983

02:30:00,309 --> 02:29:58,880

but i do think that there's a very high

3984

02:30:02,150 --> 02:30:00,319

probability that they would think of us

3985

02:30:03,030 --> 02:30:02,160

as way down the totem pole from uh and

3986

02:30:03,750 --> 02:30:03,040

it's probably because it would probably

3987

02:30:05,590 --> 02:30:03,760

be true

3988

02:30:07,429 --> 02:30:05,600

let's take our break let's take our

3989

02:30:09,190 --> 02:30:07,439

break right here i guess tonight

3990

02:30:11,590 --> 02:30:09,200

isaac arthur we're going to come back

3991

02:30:13,510 --> 02:30:11,600

and get into some overtime

3992

02:30:15,270 --> 02:30:13,520

you know it's kind of kind of strange i

3993

02:30:17,590 --> 02:30:15,280

feel like this conversation

3994

02:30:19,110 --> 02:30:17,600

just got started this is fade to black i

3995

02:30:21,110 --> 02:30:19,120

am your host jimmy church

3996

02:30:23,750 --> 02:30:21,120

more with isaac after this short break

3997

02:30:26,710 --> 02:30:23,760

and you can go right now to isaac's

3998

02:30:29,030 --> 02:30:26,720

uh website it is isaacarthur.net the

3999

02:30:35,320 --> 02:30:29,040

links are over at jimmychurchradio.com

4000

02:30:35,330 --> 02:30:49,750

[Music]

4001
02:30:54,070 --> 02:30:52,150
hey what up y'all biblical fox here and

4002
02:30:59,270 --> 02:30:54,080
you are listening to my boy

4003
02:31:09,830 --> 02:31:02,550
despite popular opinion reading a book

4004
02:31:13,670 --> 02:31:11,590
this is jimmy church of fade to black

4005
02:31:16,790 --> 02:31:13,680
and i take life change tea

4006
02:31:17,510 --> 02:31:16,800
supplements every single day it's what i

4007
02:31:20,030 --> 02:31:17,520
do

4008
02:31:23,670 --> 02:31:20,040
click on their banner at

4009
02:31:27,670 --> 02:31:25,830
when you take the beans from central

4010
02:31:30,070 --> 02:31:27,680
america with dashes of

4011
02:31:31,990 --> 02:31:30,080
indonesian and african mixed in and then

4012
02:31:34,790 --> 02:31:32,000
roasted to the dark side of

4013
02:31:35,429 --> 02:31:34,800

fade to black you create the ultimate

4014

02:31:38,710 --> 02:31:35,439

brew of

4015

02:31:39,510 --> 02:31:38,720

fringe introducing the fade to black

4016

02:31:42,790 --> 02:31:39,520

blend from

4017

02:31:45,590 --> 02:31:42,800

river moon coffee yes river moon's

4018

02:31:46,309 --> 02:31:45,600

darkest customized roast was created for

4019

02:31:49,510 --> 02:31:46,319

the love

4020

02:31:52,309 --> 02:31:49,520

of fade to black the alchemy of

4021

02:31:54,950 --> 02:31:52,319

masterful roasting and smoking the beans

4022

02:31:58,630 --> 02:31:54,960

is in every sip of this full-bodied

4023

02:32:01,190 --> 02:31:58,640

dark java i need my coffee doc

4024

02:32:02,150 --> 02:32:01,200

deep with distinct bittersweet chocolate

4025

02:32:04,710 --> 02:32:02,160

highlights

4026

02:32:06,950 --> 02:32:04,720

just like the bunker leaning further

4027

02:32:09,349 --> 02:32:06,960

into the darkness of the roast is

4028

02:32:10,230 --> 02:32:09,359

fade to black blend from river moon

4029

02:32:11,950 --> 02:32:10,240

coffee

4030

02:32:13,990 --> 02:32:11,960

just click on the banner at

4031

02:32:14,389 --> 02:32:14,000

jimmychurchradio.com and use the promo

4032

02:32:18,870 --> 02:32:14,399

code

4033

02:32:22,389 --> 02:32:18,880

f2b blend for 15 off of your order today

4034

02:32:25,990 --> 02:32:24,389

hello my name is billy carson and i'm a

4035

02:32:27,750 --> 02:32:26,000

best-selling author and the founder of

4036

02:32:29,349 --> 02:32:27,760

forbidden knowledge dot tv

4037

02:32:31,590 --> 02:32:29,359

together with my team we have built a

4038

02:32:33,190 --> 02:32:31,600

all new content streaming tv platform

4039

02:32:33,750 --> 02:32:33,200

designed with every family member in

4040

02:32:35,270 --> 02:32:33,760

mind

4041

02:32:36,950 --> 02:32:35,280

if you have ever wanted to travel the

4042

02:32:38,389 --> 02:32:36,960

world and attend lectures and workshops

4043

02:32:39,030 --> 02:32:38,399

from your favorite speakers but weren't

4044

02:32:41,750 --> 02:32:39,040

able to

4045

02:32:42,389 --> 02:32:41,760

look no further forbidden knowledge dot

4046

02:32:44,070 --> 02:32:42,399

tv

4047

02:32:45,910 --> 02:32:44,080

there are dozens of workshops and

4048

02:32:47,990 --> 02:32:45,920

lectures from speakers you know and love

4049

02:32:49,910 --> 02:32:48,000

we have also included amazing categories

4050

02:32:51,670 --> 02:32:49,920

to assure that your consciousness is

4051
02:32:52,389 --> 02:32:51,680
entertained and elevating on a daily

4052
02:32:54,469 --> 02:32:52,399
basis

4053
02:32:55,670 --> 02:32:54,479
amazing interviews ancient history

4054
02:32:57,670 --> 02:32:55,680
ascension knowledge

4055
02:32:58,870 --> 02:32:57,680
wisdom teachings documentaries

4056
02:33:01,110 --> 02:32:58,880
conspiracies

4057
02:33:03,030 --> 02:33:01,120
mysteries health and fitness conscious

4058
02:33:05,190 --> 02:33:03,040
cooking meditations finance

4059
02:33:07,590 --> 02:33:05,200
yoga and so much more to start your free

4060
02:33:10,230 --> 02:33:07,600
trial on any mobile device or computer

4061
02:33:10,710 --> 02:33:10,240
surf there forbidden knowledge dot tv

4062
02:33:12,790 --> 02:33:10,720
that's

4063
02:33:15,030 --> 02:33:12,800

forbidden knowledge with the number four

4064

02:33:19,110 --> 02:33:15,040

forbidden knowledge dot tv

4065

02:33:21,349 --> 02:33:19,120

today

4066

02:33:24,150 --> 02:33:21,359

are you intrigued by paranormal talk

4067

02:33:24,550 --> 02:33:24,160

radio you love the new paranormal radio

4068

02:33:27,510 --> 02:33:24,560

app

4069

02:33:29,349 --> 02:33:27,520

from talk stream live you'll find a

4070

02:33:30,389 --> 02:33:29,359

great selection of talk shows covering

4071

02:33:33,510 --> 02:33:30,399

ufos

4072

02:33:35,910 --> 02:33:33,520

ghosts strange phenomena and much more

4073

02:33:37,670 --> 02:33:35,920

download the paranormal radio app now

4074

02:33:39,590 --> 02:33:37,680

and start listening to the very best in

4075

02:33:41,110 --> 02:33:39,600

paranormal talk entertainment

4076
02:33:43,990 --> 02:33:41,120
including the network you're listening

4077
02:33:46,830 --> 02:33:44,000
to right now the paranormal radio app

4078
02:33:56,309 --> 02:33:46,840
free in google play and the ios app

4079
02:34:00,630 --> 02:33:59,349
it's not a lifestyle we chose we were

4080
02:34:08,630 --> 02:34:00,640
born this way

4081
02:34:26,630 --> 02:34:16,380
this is kjcr jimmychurchradio.com

4082
02:34:29,670 --> 02:34:26,640
[Music]

4083
02:34:32,950 --> 02:34:29,680
welcome back fade to black

4084
02:34:36,070 --> 02:34:32,960
overtime with isaac arthur

4085
02:34:36,790 --> 02:34:36,080
and this is always a fun segment of the

4086
02:34:38,710 --> 02:34:36,800
show

4087
02:34:39,830 --> 02:34:38,720
uh well we've been doing it all night

4088
02:34:42,630 --> 02:34:39,840

with isaac

4089

02:34:45,030 --> 02:34:42,640

but it's uh where we have a more uh

4090

02:34:45,510 --> 02:34:45,040

free-form uh conversation and just get

4091

02:34:48,550 --> 02:34:45,520

some fun

4092

02:34:51,030 --> 02:34:48,560

ideas out kind of take the stress

4093

02:34:52,070 --> 02:34:51,040

out of uh all those difficult questions

4094

02:34:55,670 --> 02:34:52,080

i was laying out

4095

02:34:58,870 --> 02:34:55,680

uh to you isaac uh but i appreciate

4096

02:35:03,190 --> 02:34:58,880

uh your knowledge and but i

4097

02:35:03,429 --> 02:35:03,200

i want to uh uh i i just want to ask you

4098

02:35:06,790 --> 02:35:03,439

a

4099

02:35:08,870 --> 02:35:06,800

this

4100

02:35:10,070 --> 02:35:08,880

earlier with the expansion of the

4101
02:35:13,270 --> 02:35:10,080
universe

4102
02:35:13,990 --> 02:35:13,280
okay when we get into ftl otherwise

4103
02:35:18,150 --> 02:35:14,000
known as

4104
02:35:28,870 --> 02:35:21,990
is it possible as humans

4105
02:35:32,950 --> 02:35:31,510
only in the context of uh universal

4106
02:35:35,110 --> 02:35:32,960
expansion i'd say

4107
02:35:37,190 --> 02:35:35,120
but i i just don't see any way we could

4108
02:35:40,630 --> 02:35:37,200
travel between planets in our own galaxy

4109
02:35:43,910 --> 02:35:40,640
in the fashion speed of light and

4110
02:35:45,990 --> 02:35:43,920
well the okay why

4111
02:35:47,590 --> 02:35:46,000
only inside the context of known physics

4112
02:35:50,469 --> 02:35:47,600
if tomorrow someone comes out with

4113
02:35:52,070 --> 02:35:50,479

negative energy negative matter um if

4114

02:35:53,110 --> 02:35:52,080

someone comes out with

4115

02:35:55,110 --> 02:35:53,120

a couple of different ones that might

4116

02:35:57,110 --> 02:35:55,120

allow it too but those are the big ones

4117

02:35:59,590 --> 02:35:57,120

then i changed my viewpoint on it but i

4118

02:36:00,870 --> 02:35:59,600

think it's so intrinsically linked to

4119

02:36:02,710 --> 02:36:00,880

time travel it's so

4120

02:36:04,710 --> 02:36:02,720

intrinsically linked to infinite energy

4121

02:36:06,630 --> 02:36:04,720

supplies and things like that that

4122

02:36:08,630 --> 02:36:06,640

you have to start looking as if we could

4123

02:36:10,630 --> 02:36:08,640

travel fast in light if we could break

4124

02:36:11,750 --> 02:36:10,640

einstein's basic concept of special

4125

02:36:13,270 --> 02:36:11,760

relativity

4126
02:36:14,630 --> 02:36:13,280
then it's not a question of when we

4127
02:36:16,870 --> 02:36:14,640
would do it it's a question of why

4128
02:36:19,510 --> 02:36:16,880
hasn't already happened because

4129
02:36:20,870 --> 02:36:19,520
most versions of ftl allow you to go

4130
02:36:22,870 --> 02:36:20,880
back in time

4131
02:36:24,469 --> 02:36:22,880
and uh there's always the old joke by

4132
02:36:25,030 --> 02:36:24,479
those ads they say what year was time

4133
02:36:28,550 --> 02:36:25,040
travel

4134
02:36:30,309 --> 02:36:28,560
discovered uh every year you know

4135
02:36:31,270 --> 02:36:30,319
uh there should be you know at that

4136
02:36:33,030 --> 02:36:31,280
point you're not just dealing with

4137
02:36:34,469 --> 02:36:33,040
aliens from another galaxy

4138
02:36:35,990 --> 02:36:34,479

you're dealing with effective aliens

4139

02:36:37,030 --> 02:36:36,000

from your own future you know you have

4140

02:36:38,790 --> 02:36:37,040

to worry about

4141

02:36:40,469 --> 02:36:38,800

is somebody from your far distant future

4142

02:36:41,670 --> 02:36:40,479

going to take over your plan to monitor

4143

02:36:43,270 --> 02:36:41,680

resources

4144

02:36:44,790 --> 02:36:43,280

could we travel back in time to when the

4145

02:36:48,150 --> 02:36:44,800

earth was very new

4146

02:36:51,270 --> 02:36:48,160

and uh colonized back then well

4147

02:36:55,030 --> 02:36:51,280

you've done so many episodes on

4148

02:36:58,469 --> 02:36:55,040

on faster than light uh travel and have

4149

02:37:02,230 --> 02:36:58,479

explored this uh subject so much

4150

02:37:05,429 --> 02:37:02,240

that if okay if we remove

4151
02:37:08,630 --> 02:37:05,439
the the uh

4152
02:37:11,750 --> 02:37:08,640
backwards in time element from it

4153
02:37:15,030 --> 02:37:11,760
and alien civilizations are

4154
02:37:17,110 --> 02:37:15,040
traveling at faster than light we would

4155
02:37:18,389 --> 02:37:17,120
never observe it we would never see it

4156
02:37:21,429 --> 02:37:18,399
where we are looking

4157
02:37:23,270 --> 02:37:21,439
for motion between planets and stars

4158
02:37:24,790 --> 02:37:23,280
out there in the galaxy if this is

4159
02:37:26,870 --> 02:37:24,800
happening

4160
02:37:29,670 --> 02:37:26,880
we would potentially never see it would

4161
02:37:32,070 --> 02:37:29,680
we we wouldn't see any trade routes

4162
02:37:32,950 --> 02:37:32,080
possibly um you know one example that

4163
02:37:34,950 --> 02:37:32,960

comes up is

4164

02:37:36,469 --> 02:37:34,960

what's the what's driving the spaceship

4165

02:37:37,830 --> 02:37:36,479

and then we say you detect it by

4166

02:37:39,429 --> 02:37:37,840

butterflies pushing it

4167

02:37:41,190 --> 02:37:39,439

if it's running on say a black hole for

4168

02:37:42,950 --> 02:37:41,200

instance like a hocking drive

4169

02:37:44,469 --> 02:37:42,960

um you know that way you should be

4170

02:37:46,630 --> 02:37:44,479

seeing all the gamma radiation

4171

02:37:48,309 --> 02:37:46,640

associated to a ship of that mass at a

4172

02:37:51,030 --> 02:37:48,319

very specific frequency

4173

02:37:52,870 --> 02:37:51,040

um same for if people are dicing stars

4174

02:37:55,110 --> 02:37:52,880

up to make lots of o'neill cylinders

4175

02:37:57,429 --> 02:37:55,120

then we should see big blobs at uh

4176
02:37:58,469 --> 02:37:57,439
10 micrometers wavelength associated

4177
02:38:00,070 --> 02:37:58,479
with temperature

4178
02:38:01,750 --> 02:38:00,080
if they are moving from point a to point

4179
02:38:04,070 --> 02:38:01,760
b we should see

4180
02:38:06,309 --> 02:38:04,080
some motion for that there's always

4181
02:38:08,389 --> 02:38:06,319
something left behind for forensics

4182
02:38:09,910 --> 02:38:08,399
maybe if they're traveling faster than

4183
02:38:11,429 --> 02:38:09,920
light we will be seeing

4184
02:38:13,110 --> 02:38:11,439
a particular type of particle being

4185
02:38:14,070 --> 02:38:13,120
created in their wake where there should

4186
02:38:16,150 --> 02:38:14,080
be something

4187
02:38:17,510 --> 02:38:16,160
but if it was like star gates sg-1 style

4188
02:38:19,270 --> 02:38:17,520

where they just have wormhole gates they

4189

02:38:21,190 --> 02:38:19,280

open up between plant and plants

4190

02:38:23,030 --> 02:38:21,200

then no we probably wouldn't say that

4191

02:38:24,389 --> 02:38:23,040

but again with things like that

4192

02:38:26,389 --> 02:38:24,399

we can't be certain they'd be traveling

4193

02:38:28,309 --> 02:38:26,399

inside our universe

4194

02:38:29,590 --> 02:38:28,319

the math on things like wormholes works

4195

02:38:31,030 --> 02:38:29,600

just as well for traveling to another

4196

02:38:32,389 --> 02:38:31,040

universe as to our own

4197

02:38:33,590 --> 02:38:32,399

sure they might be doing that example

4198

02:38:35,349 --> 02:38:33,600

it's just earlier where they travel to

4199

02:38:36,870 --> 02:38:35,359

their own parallel worlds

4200

02:38:38,790 --> 02:38:36,880

but if they are traveling inside our

4201
02:38:40,389 --> 02:38:38,800
universe there has to be some kind of

4202
02:38:41,670 --> 02:38:40,399
effect we could detect

4203
02:38:43,830 --> 02:38:41,680
it might be really tiny and beyond

4204
02:38:48,230 --> 02:38:43,840
ability now though but are we

4205
02:38:50,389 --> 02:38:48,240
observing this all the time and

4206
02:38:51,349 --> 02:38:50,399
immediately thinking it's something

4207
02:38:52,950 --> 02:38:51,359
natural

4208
02:38:54,870 --> 02:38:52,960
something completely mundane right

4209
02:38:56,150 --> 02:38:54,880
that's entirely possible a problem with

4210
02:38:58,230 --> 02:38:56,160
science is that we we

4211
02:38:59,590 --> 02:38:58,240
work from the get-go that's why we say

4212
02:39:00,950 --> 02:38:59,600
always be kind of careful being too

4213
02:39:02,389 --> 02:39:00,960

reductionist on things

4214

02:39:03,910 --> 02:39:02,399

our initial assumption is that

4215

02:39:05,510 --> 02:39:03,920

everything is constant effect in an

4216

02:39:08,469 --> 02:39:05,520

actual universe

4217

02:39:10,230 --> 02:39:08,479

um that is the stance we take for a very

4218

02:39:11,670 --> 02:39:10,240

clear philosophical reason laid out back

4219

02:39:13,670 --> 02:39:11,680

in the early days of it but

4220

02:39:14,790 --> 02:39:13,680

it is still there that's a bias there we

4221

02:39:17,190 --> 02:39:14,800

assume

4222

02:39:18,950 --> 02:39:17,200

everything is a cause and effect in a

4223

02:39:20,070 --> 02:39:18,960

natural universe that is a natural

4224

02:39:22,550 --> 02:39:20,080

effect

4225

02:39:23,510 --> 02:39:22,560

and for that reason if we see something

4226
02:39:24,469 --> 02:39:23,520
that's weird the first thing we do is

4227
02:39:25,910 --> 02:39:24,479
try to figure out what could be

4228
02:39:27,110 --> 02:39:25,920
naturally causing it which is the good

4229
02:39:29,750 --> 02:39:27,120
approach to take but

4230
02:39:30,870 --> 02:39:29,760
well nobody nobody wants to say et in

4231
02:39:34,389 --> 02:39:30,880
the sciences

4232
02:39:35,830 --> 02:39:34,399
right it's not it's not the go-to place

4233
02:39:36,230 --> 02:39:35,840
but it's the same with like alcubierre

4234
02:39:38,150 --> 02:39:36,240
he was

4235
02:39:39,270 --> 02:39:38,160
perfectly allowed to say it right right

4236
02:39:42,070 --> 02:39:39,280
right i know

4237
02:39:42,550 --> 02:39:42,080
lots of like uh uh most astrophysics i

4238
02:39:44,309 --> 02:39:42,560

know

4239

02:39:46,070 --> 02:39:44,319

they chat about this stuff they're all

4240

02:39:47,190 --> 02:39:46,080

raised on star trek too

4241

02:39:49,110 --> 02:39:47,200

uh do they want to be the one who

4242

02:39:50,550 --> 02:39:49,120

publishes the paper saying that's the

4243

02:39:52,389 --> 02:39:50,560

likely interpretation

4244

02:39:53,750 --> 02:39:52,399

well maybe not but the fellow i can't

4245

02:39:54,710 --> 02:39:53,760

believe his name right now jason sunday

4246

02:39:57,270 --> 02:39:54,720

brother for um

4247

02:39:58,150 --> 02:39:57,280

tabby star he came out saying it might

4248

02:39:59,830 --> 02:39:58,160

be

4249

02:40:00,950 --> 02:39:59,840

aliens and we didn't laugh about that

4250

02:40:01,270 --> 02:40:00,960

because there's one thing we all thought

4251
02:40:03,910 --> 02:40:01,280
too

4252
02:40:04,630 --> 02:40:03,920
it might be aliens probably not i

4253
02:40:07,429 --> 02:40:04,640
assumption was

4254
02:40:07,830 --> 02:40:07,439
a scattered debris disk you know but it

4255
02:40:09,110 --> 02:40:07,840
it

4256
02:40:11,110 --> 02:40:09,120
if you go there that's one of the four

4257
02:40:12,790 --> 02:40:11,120
scenes you go that's a bizarre anomaly

4258
02:40:14,870 --> 02:40:12,800
and your brain just says well that maybe

4259
02:40:16,309 --> 02:40:14,880
it's not an army maybe it's unofficial

4260
02:40:18,630 --> 02:40:16,319
but you have a responsibility to try to

4261
02:40:20,389 --> 02:40:18,640
look for the natural options first

4262
02:40:21,670 --> 02:40:20,399
but not the exclusion of not considering

4263
02:40:25,030 --> 02:40:21,680

the artificial

4264

02:40:27,190 --> 02:40:25,040

well then you have omuamua there's a

4265

02:40:29,590 --> 02:40:27,200

that's another classic example

4266

02:40:30,550 --> 02:40:29,600

of obviously the first interstellar

4267

02:40:35,190 --> 02:40:30,560

object

4268

02:40:37,910 --> 02:40:35,200

it increases speed it makes a turn exits

4269

02:40:39,590 --> 02:40:37,920

out of our solar system uh everything

4270

02:40:43,429 --> 02:40:39,600

that it did

4271

02:40:43,990 --> 02:40:43,439

also it was rama it kind of looked like

4272

02:40:47,110 --> 02:40:44,000

rama

4273

02:40:47,990 --> 02:40:47,120

if you really think about it uh nicely

4274

02:40:50,550 --> 02:40:48,000

done

4275

02:40:52,389 --> 02:40:50,560

but um i'm trying to think of the

4276

02:40:55,830 --> 02:40:52,399

physicist from harvard

4277

02:40:59,110 --> 02:40:55,840

who's been pretty vocal over the last uh

4278

02:41:02,309 --> 02:40:59,120

couple of years with omumu yeah and

4279

02:41:03,030 --> 02:41:02,319

uh uh i'll think of it here in just a

4280

02:41:06,870 --> 02:41:03,040

second

4281

02:41:10,550 --> 02:41:06,880

um but over the last six months

4282

02:41:11,349 --> 02:41:10,560

he is he is he's put his career on the

4283

02:41:13,750 --> 02:41:11,359

line

4284

02:41:17,269 --> 02:41:13,760

that this is extraterrestrial that this

4285

02:41:18,630 --> 02:41:17,279

is an extraterrestrial object

4286

02:41:20,550 --> 02:41:18,640

i wish i could remember his name right

4287

02:41:22,070 --> 02:41:20,560

now but i remember him so i know it was

4288

02:41:23,429 --> 02:41:22,080

in the last six months but somebody

4289

02:41:25,429 --> 02:41:23,439

maybe it was a different person too it

4290

02:41:25,990 --> 02:41:25,439

had but somebody was very well known in

4291

02:41:27,429 --> 02:41:26,000

the field

4292

02:41:29,030 --> 02:41:27,439

had said that he thought it was probably

4293

02:41:30,550 --> 02:41:29,040

extraterrestrial or artificial

4294

02:41:32,389 --> 02:41:30,560

i should say good video was

4295

02:41:35,510 --> 02:41:32,399

extraterrestrial um

4296

02:41:37,030 --> 02:41:35,520

or extra solar specifically but uh i

4297

02:41:39,110 --> 02:41:37,040

usually go the other way around and as i

4298

02:41:40,389 --> 02:41:39,120

say if it's an alien probe or an alien

4299

02:41:42,710 --> 02:41:40,399

device it's

4300

02:41:44,150 --> 02:41:42,720

broken because it's not acting like it

4301
02:41:45,670 --> 02:41:44,160
should be which is fine it might be a

4302
02:41:47,110 --> 02:41:45,680
broken probe you know if he's finding

4303
02:41:48,950 --> 02:41:47,120
other people's garbages but of ways we

4304
02:41:50,230 --> 02:41:48,960
find other civilizations

4305
02:41:51,910 --> 02:41:50,240
almost everything we know about other

4306
02:41:53,190 --> 02:41:51,920
civilizations our own past is by looking

4307
02:41:55,269 --> 02:41:53,200
at garbage but

4308
02:41:57,269 --> 02:41:55,279
if a muramura was an artificial

4309
02:41:59,910 --> 02:41:57,279
construct it's a broken one now because

4310
02:42:01,670 --> 02:41:59,920
it's not at the microprobe should

4311
02:42:03,110 --> 02:42:01,680
um either from the point of trying to

4312
02:42:05,590 --> 02:42:03,120
hide itself where it looked at us

4313
02:42:07,990 --> 02:42:05,600

or trying to get in close for a look but

4314

02:42:12,710 --> 02:42:08,000

that works it could be a broken probe

4315

02:42:16,150 --> 02:42:12,720

it uh it it changed velocity

4316

02:42:19,990 --> 02:42:16,160

a few times it did make a turn

4317

02:42:21,349 --> 02:42:20,000

um it was projecting something out of

4318

02:42:23,429 --> 02:42:21,359

the back end of it

4319

02:42:25,750 --> 02:42:23,439

so it could increase speed all of that

4320

02:42:29,590 --> 02:42:25,760

was measured and observed

4321

02:42:32,790 --> 02:42:29,600

um and having that occur naturally

4322

02:42:34,710 --> 02:42:32,800

yeah you know you think so um sure

4323

02:42:36,070 --> 02:42:34,720

how do comets do if you look at a

4324

02:42:37,429 --> 02:42:36,080

comet's motion and you look at it

4325

02:42:39,030 --> 02:42:37,439

strictly from a

4326

02:42:39,910 --> 02:42:39,040

cavalian orbit standpoint you say oh

4327

02:42:40,870 --> 02:42:39,920

that's not right it's not doing what

4328

02:42:42,309 --> 02:42:40,880

it's supposed to

4329

02:42:43,429 --> 02:42:42,319

because it's emitting a rocket flame out

4330

02:42:44,790 --> 02:42:43,439

the back of it that's that's what

4331

02:42:46,150 --> 02:42:44,800

happens when the sunlight strikes it and

4332

02:42:47,110 --> 02:42:46,160

caused stuff to come off

4333

02:42:48,550 --> 02:42:47,120

that thing traveled through the

4334

02:42:50,070 --> 02:42:48,560

interstellar void and collected a lot of

4335

02:42:52,070 --> 02:42:50,080

cold gas on its way that could be

4336

02:42:53,429 --> 02:42:52,080

blowing off it as an ablative rocket

4337

02:42:55,349 --> 02:42:53,439

tail comet tail

4338

02:42:57,030 --> 02:42:55,359

um now others would say well it's not

4339

02:42:58,469 --> 02:42:57,040

the right amount it's not doing quite

4340

02:42:59,110 --> 02:42:58,479

the right amount it should for what it

4341

02:43:00,710 --> 02:42:59,120

did

4342

02:43:02,550 --> 02:43:00,720

but we don't have the very precise

4343

02:43:03,910 --> 02:43:02,560

measurements on either because it's not

4344

02:43:05,030 --> 02:43:03,920

big i think you know we say it looks

4345

02:43:06,469 --> 02:43:05,040

like drama well i think it's only 100

4346

02:43:08,309 --> 02:43:06,479

meters across it's

4347

02:43:09,670 --> 02:43:08,319

it's big but ain't no wrong they know

4348

02:43:12,870 --> 02:43:09,680

what we need or cylinder

4349

02:43:14,389 --> 02:43:12,880

um and uh we can't get really good

4350

02:43:16,630 --> 02:43:14,399

measurements out of things like that

4351
02:43:17,910 --> 02:43:16,640
uh you know if we i'd love to chase

4352
02:43:19,269 --> 02:43:17,920
thing down get a better look at it we'll

4353
02:43:19,750 --> 02:43:19,279
probably get more chance to see more of

4354
02:43:22,630 --> 02:43:19,760
them

4355
02:43:24,150 --> 02:43:22,640
at least i hope so but uh you know we

4356
02:43:24,630 --> 02:43:24,160
can't know that that was not a natural

4357
02:43:26,389 --> 02:43:24,640
object

4358
02:43:28,309 --> 02:43:26,399
in terms of its motion we just know it

4359
02:43:29,910 --> 02:43:28,319
acted very weirdly but then again it's a

4360
02:43:33,830 --> 02:43:29,920
pretty weird object

4361
02:43:36,950 --> 02:43:33,840
and now we have fast radio bursts again

4362
02:43:39,030 --> 02:43:36,960
trying to explain these

4363
02:43:40,150 --> 02:43:39,040

uh the first you know it that it's

4364

02:43:42,870 --> 02:43:40,160

natural

4365

02:43:43,750 --> 02:43:42,880

you know it's just it's a supernova it's

4366

02:43:46,150 --> 02:43:43,760

you know

4367

02:43:48,150 --> 02:43:46,160

these different aspects of it but now

4368

02:43:50,550 --> 02:43:48,160

they're repeating

4369

02:43:53,349 --> 02:43:50,560

and is this starting to confuse science

4370

02:43:55,269 --> 02:43:53,359

a little bit where you're trying to

4371

02:43:56,710 --> 02:43:55,279

you know make it natural but sometimes

4372

02:43:59,110 --> 02:43:56,720

you just can't

4373

02:44:00,550 --> 02:43:59,120

i hope so yeah if you can't if you're

4374

02:44:01,750 --> 02:44:00,560

looking at every anomaly and you're not

4375

02:44:03,349 --> 02:44:01,760

finding something that's confusing and

4376
02:44:06,230 --> 02:44:03,359
weird then you're not doing it right

4377
02:44:07,670 --> 02:44:06,240
um if you know fast radio bus there's

4378
02:44:09,590 --> 02:44:07,680
some phenomena that could potentially

4379
02:44:10,710 --> 02:44:09,600
be it but the goal on these things is

4380
02:44:12,150 --> 02:44:10,720
now to say well

4381
02:44:13,030 --> 02:44:12,160
this is the natural explanation because

4382
02:44:13,830 --> 02:44:13,040
you're not supposed to be trying to

4383
02:44:14,950 --> 02:44:13,840
figure out

4384
02:44:16,150 --> 02:44:14,960
why it's natural it's supposed to be

4385
02:44:17,990 --> 02:44:16,160
trying to figure out what it is that

4386
02:44:19,590 --> 02:44:18,000
might be that it's alien too

4387
02:44:21,030 --> 02:44:19,600
i usually say the good sign that'll be

4388
02:44:22,389 --> 02:44:21,040

artificial is if it's coming up with at

4389

02:44:23,429 --> 02:44:22,399

least two different hits that are we

4390

02:44:25,110 --> 02:44:23,439

owed that way

4391

02:44:26,870 --> 02:44:25,120

two different anomalies you'd associate

4392

02:44:28,790 --> 02:44:26,880

to intelligence because you know again

4393

02:44:29,750 --> 02:44:28,800

if you walk into an alien workshop

4394

02:44:31,830 --> 02:44:29,760

you're gonna know

4395

02:44:33,110 --> 02:44:31,840

that that is an alien workshop or at

4396

02:44:34,469 --> 02:44:33,120

least that's artificial

4397

02:44:35,910 --> 02:44:34,479

regardless whether you know what things

4398

02:44:37,030 --> 02:44:35,920

are the screwdrivers might look like the

4399

02:44:38,469 --> 02:44:37,040

hammers might look long

4400

02:44:40,790 --> 02:44:38,479

but they're not going to look you know

4401
02:44:41,830 --> 02:44:40,800
natural you find one hammer by itself

4402
02:44:43,429 --> 02:44:41,840
you might say well that

4403
02:44:45,670 --> 02:44:43,439
you know it's decayed maybe that's

4404
02:44:48,309 --> 02:44:45,680
natural you find a whole workshop

4405
02:44:49,670 --> 02:44:48,319
yeah you know it's artificial and that's

4406
02:44:51,030 --> 02:44:49,680
what i tend to look for these anomalies

4407
02:44:52,230 --> 02:44:51,040
is the multiple things it's not it's

4408
02:44:53,910 --> 02:44:52,240
tabby's stall

4409
02:44:55,429 --> 02:44:53,920
maybe a dyson sphere says well we look

4410
02:44:56,389 --> 02:44:55,439
at and where's the radio signals for

4411
02:44:58,150 --> 02:44:56,399
that place or

4412
02:44:59,750 --> 02:44:58,160
where's the infrared based heat at 300

4413
02:45:01,670 --> 02:44:59,760

kelvin or something like that

4414

02:45:03,269 --> 02:45:01,680

for the fast radio boss the thing is

4415

02:45:04,389 --> 02:45:03,279

what's the data that's encoded in there

4416

02:45:07,510 --> 02:45:04,399

and why are they doing it

4417

02:45:08,630 --> 02:45:07,520

why why that method of signaling um but

4418

02:45:09,670 --> 02:45:08,640

it might be a natural phenomenon it

4419

02:45:11,990 --> 02:45:09,680

might be artificial

4420

02:45:14,230 --> 02:45:12,000

the goal is not to say what it is is to

4421

02:45:16,710 --> 02:45:14,240

find out what it actually is

4422

02:45:18,150 --> 02:45:16,720

and that is a thing i i warn skeptics

4423

02:45:19,990 --> 02:45:18,160

about is

4424

02:45:21,830 --> 02:45:20,000

you're supposed to be skeptical about

4425

02:45:22,790 --> 02:45:21,840

every possible solution you're not

4426

02:45:24,309 --> 02:45:22,800

supposed to be going in there

4427

02:45:26,150 --> 02:45:24,319

trying to figure out that this thing is

4428

02:45:27,190 --> 02:45:26,160

definitely natural because eventually

4429

02:45:28,469 --> 02:45:27,200

you're going to come across something

4430

02:45:29,110 --> 02:45:28,479

isn't most of our experiences with

4431

02:45:30,870 --> 02:45:29,120

things that are

4432

02:45:33,110 --> 02:45:30,880

artificial uh what's the only problem on

4433

02:45:34,150 --> 02:45:33,120

this planet is artificial origin so

4434

02:45:36,230 --> 02:45:34,160

when you're studying science and

4435

02:45:39,309 --> 02:45:36,240

phenomena phenomena on earth your first

4436

02:45:42,389 --> 02:45:39,319

go-to should be this is artificial

4437

02:45:45,590 --> 02:45:42,399

yeah and uh

4438

02:45:47,750 --> 02:45:45,600

i uh i i

4439

02:45:49,030 --> 02:45:47,760

i did a calculation i did this a couple

4440

02:45:51,910 --> 02:45:49,040

of years ago

4441

02:45:53,910 --> 02:45:51,920

um where i started to think about the

4442

02:45:56,710 --> 02:45:53,920

basics marconi

4443

02:45:58,630 --> 02:45:56,720

television you know how long of these

4444

02:46:00,389 --> 02:45:58,640

radio signals the big ones and

4445

02:46:02,389 --> 02:46:00,399

television signals been

4446

02:46:05,269 --> 02:46:02,399

you know leaving this planet you know

4447

02:46:07,750 --> 02:46:05,279

it's not necessarily the movie contact

4448

02:46:08,309 --> 02:46:07,760

i went the opposite direction i said

4449

02:46:12,389 --> 02:46:08,319

okay

4450

02:46:14,630 --> 02:46:12,399

a hundred years out a hundred years out

4451
02:46:15,429 --> 02:46:14,640
what is out there and and and what do we

4452
02:46:19,190 --> 02:46:15,439
know

4453
02:46:23,670 --> 02:46:19,200
well i came back with a number

4454
02:46:26,389 --> 02:46:23,680
i think it was about 250. it's about 250

4455
02:46:30,389 --> 02:46:29,590
less less than 100 years away light

4456
02:46:32,469 --> 02:46:30,399
years away

4457
02:46:35,190 --> 02:46:32,479
okay it's about 15 thousand dollars 100

4458
02:46:38,309 --> 02:46:35,200
light years but okay

4459
02:46:39,750 --> 02:46:38,319
okay okay well i think my number was 250

4460
02:46:43,349 --> 02:46:39,760
doesn't matter

4461
02:46:46,870 --> 02:46:43,359
in that because

4462
02:46:50,550 --> 02:46:46,880
50 years coming back right

4463
02:46:53,670 --> 02:46:50,560

so it would be 100 years out

4464

02:46:55,510 --> 02:46:53,680

how many how much time coming back to us

4465

02:46:56,950 --> 02:46:55,520

so oh that was my calculation i went

4466

02:46:58,150 --> 02:46:56,960

with four years you're doing a 50 light

4467

02:46:59,990 --> 02:46:58,160

year radius so 15

4468

02:47:01,830 --> 02:47:00,000

50 light year radius and i came up with

4469

02:47:07,269 --> 02:47:01,840

250 stars

4470

02:47:09,750 --> 02:47:07,279

so we should technically start to see

4471

02:47:10,550 --> 02:47:09,760

some kind of response from now moving

4472

02:47:13,269 --> 02:47:10,560

forward

4473

02:47:14,630 --> 02:47:13,279

we wouldn't have gotten it 25 years ago

4474

02:47:16,230 --> 02:47:14,640

right every period of time

4475

02:47:17,670 --> 02:47:16,240

if you double the time that signals out

4476

02:47:19,990 --> 02:47:17,680

there that means eight

4477

02:47:20,950 --> 02:47:20,000

times as many stars that's reached so

4478

02:47:23,429 --> 02:47:20,960

like

4479

02:47:24,070 --> 02:47:23,439

let's say that uh we are not measuring a

4480

02:47:25,910 --> 02:47:24,080

century but

4481

02:47:27,990 --> 02:47:25,920

a thousand years whatever it could have

4482

02:47:29,750 --> 02:47:28,000

got to in a century in a thousand years

4483

02:47:31,990 --> 02:47:29,760

it would have gotten to

4484

02:47:33,990 --> 02:47:32,000

10 cubed of that distance or another

4485

02:47:35,590 --> 02:47:34,000

thousand times me stars

4486

02:47:37,349 --> 02:47:35,600

ten thousand years now you're up to a

4487

02:47:38,870 --> 02:47:37,359

million times many stars

4488

02:47:40,550 --> 02:47:38,880

so that volume of people who could hear

4489

02:47:43,030 --> 02:47:40,560

us is going to just keep going up

4490

02:47:44,550 --> 02:47:43,040

with the cube of the time that's had to

4491

02:47:46,870 --> 02:47:44,560

to reach out to them

4492

02:47:48,070 --> 02:47:46,880

um it's not that me yet but it's getting

4493

02:47:49,510 --> 02:47:48,080

there and it's getting there

4494

02:47:50,790 --> 02:47:49,520

the signal gets weaker right it's going

4495

02:47:51,750 --> 02:47:50,800

down with the well with the square of

4496

02:47:53,830 --> 02:47:51,760

the distance

4497

02:47:55,269 --> 02:47:53,840

but you you know they say how far away

4498

02:47:56,070 --> 02:47:55,279

can you hear a signal and people say

4499

02:47:57,429 --> 02:47:56,080

these numbers say

4500

02:47:59,349 --> 02:47:57,439

you're going to hear it 100 light years

4501

02:48:01,349 --> 02:47:59,359

away i don't know where to get that

4502

02:48:03,030 --> 02:48:01,359

you can build something bigger you know

4503

02:48:04,950 --> 02:48:03,040

it we couldn't hear it

4504

02:48:07,110 --> 02:48:04,960

we couldn't hear it with our current

4505

02:48:07,990 --> 02:48:07,120

dishes but we can build a bigger dish we

4506

02:48:09,429 --> 02:48:08,000

want to

4507

02:48:11,349 --> 02:48:09,439

they can build a bigger dish they want

4508

02:48:12,790 --> 02:48:11,359

to you can build two dishes that are

4509

02:48:14,790 --> 02:48:12,800

half a light year apart that could pick

4510

02:48:16,870 --> 02:48:14,800

out the size of that you build two

4511

02:48:17,910 --> 02:48:16,880

gigantic dishes the size of planet and

4512

02:48:19,429 --> 02:48:17,920

pencil thin

4513

02:48:20,710 --> 02:48:19,439

then i'll light your costs and you'll be

4514

02:48:21,830 --> 02:48:20,720

able to pick a signal out from another

4515

02:48:25,590 --> 02:48:21,840

galaxy

4516

02:48:26,950 --> 02:48:25,600

right exactly so um and and i have two

4517

02:48:29,830 --> 02:48:26,960

questions

4518

02:48:31,670 --> 02:48:29,840

so if if that is the case the first

4519

02:48:32,870 --> 02:48:31,680

one's the simple one the second one is

4520

02:48:36,309 --> 02:48:32,880

your opinion

4521

02:48:39,110 --> 02:48:36,319

but how easy would it be

4522

02:48:39,990 --> 02:48:39,120

at uh you know a thousand light years

4523

02:48:43,349 --> 02:48:40,000

out or

4524

02:48:44,230 --> 02:48:43,359

or a hundred light years out to know the

4525

02:48:47,269 --> 02:48:44,240

direction

4526

02:48:50,790 --> 02:48:47,279

of the the signals coming at you

4527

02:48:51,670 --> 02:48:50,800

are they able to pinpoint into our solar

4528

02:48:54,070 --> 02:48:51,680

system

4529

02:48:55,269 --> 02:48:54,080

they should be it depends on how split

4530

02:48:56,230 --> 02:48:55,279

out they are because you got to do that

4531

02:48:58,389 --> 02:48:56,240

pale axe thing

4532

02:48:59,510 --> 02:48:58,399

that's right that's right yeah and if

4533

02:49:00,950 --> 02:48:59,520

you've got the you know

4534

02:49:02,950 --> 02:49:00,960

if the signals are p over the course of

4535

02:49:04,469 --> 02:49:02,960

a year then you've got your whole plants

4536

02:49:06,469 --> 02:49:04,479

motion so 2au

4537

02:49:08,230 --> 02:49:06,479

right or if you just have a satellite

4538

02:49:09,349 --> 02:49:08,240

that's in your l3 it's on the other side

4539

02:49:11,269 --> 02:49:09,359

of the sun for you that you

4540

02:49:12,870 --> 02:49:11,279

pick yourself simultaneously with that's

4541

02:49:14,230 --> 02:49:12,880

parallax for 2au

4542

02:49:15,910 --> 02:49:14,240

you can pick out pretty good with that

4543

02:49:17,429 --> 02:49:15,920

you know you can pick out most things

4544

02:49:18,790 --> 02:49:17,439

inside this galaxy if you're

4545

02:49:19,830 --> 02:49:18,800

discriminating enough with that

4546

02:49:22,230 --> 02:49:19,840

but you're not limited to that you could

4547

02:49:24,070 --> 02:49:22,240

put one out where pluto is or in another

4548

02:49:26,790 --> 02:49:24,080

star system with your text up for it

4549

02:49:27,750 --> 02:49:26,800

and this i only bring this up because of

4550

02:49:30,790 --> 02:49:27,760

hawking's big

4551
02:49:32,710 --> 02:49:30,800
warning right you got to be careful you

4552
02:49:34,550 --> 02:49:32,720
don't know who's listening

4553
02:49:36,230 --> 02:49:34,560
and i love stephen hawking for that but

4554
02:49:37,349 --> 02:49:36,240
i i have to say he tends to repeat

4555
02:49:38,309 --> 02:49:37,359
things that people had previously said

4556
02:49:41,030 --> 02:49:38,319
and had them attributed to him as

4557
02:49:44,070 --> 02:49:41,040
original like churchill

4558
02:49:47,110 --> 02:49:44,080
um um but

4559
02:49:50,550 --> 02:49:47,120
if you uh were

4560
02:49:54,150 --> 02:49:50,560
looking for or expecting uh

4561
02:49:58,150 --> 02:49:54,160
a reach out from a distant

4562
02:50:02,389 --> 02:49:58,160
start what what would you be looking for

4563
02:50:04,150 --> 02:50:02,399

you know if they are responding to us

4564

02:50:06,070 --> 02:50:04,160

uh i mean you look for everything you

4565

02:50:07,510 --> 02:50:06,080

can think of that might be a sign of

4566

02:50:08,710 --> 02:50:07,520

artificiality but the way i do it

4567

02:50:09,830 --> 02:50:08,720

personally

4568

02:50:11,510 --> 02:50:09,840

i definitely go with at least two

4569

02:50:12,070 --> 02:50:11,520

different methods for the same reason

4570

02:50:14,389 --> 02:50:12,080

but

4571

02:50:15,910 --> 02:50:14,399

i'd probably send a repeating sequence

4572

02:50:16,550 --> 02:50:15,920

of a mathematical sequence something

4573

02:50:19,750 --> 02:50:16,560

like

4574

02:50:21,990 --> 02:50:19,760

1 4 9 16 et cetera in binary

4575

02:50:22,950 --> 02:50:22,000

or i'd send digits of pi in binary you

4576

02:50:25,190 --> 02:50:22,960

know send

4577

02:50:26,389 --> 02:50:25,200

a thousand digits to pi however much

4578

02:50:27,990 --> 02:50:26,399

people might argue about the naturalness

4579

02:50:29,269 --> 02:50:28,000

so say the wow signal

4580

02:50:31,269 --> 02:50:29,279

no one's going to argue about whether or

4581

02:50:31,830 --> 02:50:31,279

not we've got the digits of pi the first

4582

02:50:33,510 --> 02:50:31,840

thousand

4583

02:50:35,190 --> 02:50:33,520

over and over again that's not an actual

4584

02:50:38,070 --> 02:50:35,200

number and that comes along

4585

02:50:38,870 --> 02:50:38,080

interspace with 1 4 you know 9 16 et

4586

02:50:40,389 --> 02:50:38,880

cetera

4587

02:50:42,309 --> 02:50:40,399

that's not natural and you know it's not

4588

02:50:43,269 --> 02:50:42,319

natural and people might come with a

4589

02:50:45,110 --> 02:50:43,279

reason why maybe pi

4590

02:50:46,070 --> 02:50:45,120

was being created by a neutron star

4591

02:50:47,269 --> 02:50:46,080

they're not going to do it at the same

4592

02:50:49,750 --> 02:50:47,279

time saying one for

4593

02:50:51,110 --> 02:50:49,760

9 etc that's how you do that and that's

4594

02:50:53,030 --> 02:50:51,120

not the signal

4595

02:50:54,550 --> 02:50:53,040

although that carries some information

4596

02:50:55,670 --> 02:50:54,560

what's that say that says

4597

02:50:57,670 --> 02:50:55,680

here we are here's where we're

4598

02:51:00,070 --> 02:50:57,680

transmitting from we know where you

4599

02:51:01,110 --> 02:51:00,080

are and we want to talk that's what that

4600

02:51:02,309 --> 02:51:01,120

signal says

4601
02:51:03,590 --> 02:51:02,319
because it's probably not coming as a

4602
02:51:05,750 --> 02:51:03,600
radio signal zombie direction was

4603
02:51:08,790 --> 02:51:05,760
probably coming pinpoint at you

4604
02:51:10,230 --> 02:51:08,800
um i would probably if i was that

4605
02:51:11,590 --> 02:51:10,240
accurate then i'd probably try to send

4606
02:51:12,950 --> 02:51:11,600
the signal and something whatever their

4607
02:51:13,910 --> 02:51:12,960
day length was too

4608
02:51:15,990 --> 02:51:13,920
because you should be able to look at

4609
02:51:17,429 --> 02:51:16,000
their planet their exoplanet and say how

4610
02:51:20,230 --> 02:51:17,439
long the date length is

4611
02:51:21,910 --> 02:51:20,240
you should be able to attack that um you

4612
02:51:22,790 --> 02:51:21,920
should be able to detect what their year

4613
02:51:23,910 --> 02:51:22,800

length is

4614

02:51:25,590 --> 02:51:23,920

so if you're sending them something

4615

02:51:26,870 --> 02:51:25,600

that's uh you know the multiple of their

4616

02:51:27,670 --> 02:51:26,880

day length at your life

4617

02:51:30,230 --> 02:51:27,680

they're going to know that you're

4618

02:51:31,190 --> 02:51:30,240

talking to them specifically and you do

4619

02:51:32,150 --> 02:51:31,200

that because it means they're going to

4620

02:51:33,429 --> 02:51:32,160

answer

4621

02:51:35,110 --> 02:51:33,439

because if they're sending you something

4622

02:51:35,750 --> 02:51:35,120

that's in your own day length at your

4623

02:51:37,190 --> 02:51:35,760

length

4624

02:51:38,550 --> 02:51:37,200

they know that means you already know

4625

02:51:39,830 --> 02:51:38,560

they're there so there's no point in

4626
02:51:42,389 --> 02:51:39,840
hiding

4627
02:51:43,190 --> 02:51:42,399
uh that's probably how i would do that

4628
02:51:46,950 --> 02:51:43,200
so you would

4629
02:51:50,070 --> 02:51:46,960
what about using light instead of

4630
02:51:51,269 --> 02:51:50,080
uh radio yeah laser well that's that's

4631
02:51:52,469 --> 02:51:51,279
what you'd be doing there was a laser

4632
02:51:54,150 --> 02:51:52,479
communication blast doesn't have to

4633
02:51:56,630 --> 02:51:54,160
necessarily be light you might be

4634
02:51:58,150 --> 02:51:56,640
infrared or microwave but you use all

4635
02:51:59,990 --> 02:51:58,160
the above you point at them whatever you

4636
02:52:01,830 --> 02:52:00,000
can focus down on them real well

4637
02:52:02,870 --> 02:52:01,840
and it just depends again if you're

4638
02:52:04,150 --> 02:52:02,880

looking at them and they're already

4639

02:52:06,150 --> 02:52:04,160

transmitting like us

4640

02:52:07,349 --> 02:52:06,160

you know a lot about them you send a

4641

02:52:08,550 --> 02:52:07,359

targeted message at them because that

4642

02:52:11,190 --> 02:52:08,560

tells them

4643

02:52:13,110 --> 02:52:11,200

i'm looking at you specifically this is

4644

02:52:15,110 --> 02:52:13,120

not omnidirectional this is not a

4645

02:52:16,230 --> 02:52:15,120

hey is anybody out there it's a i know

4646

02:52:18,710 --> 02:52:16,240

you're out there

4647

02:52:20,070 --> 02:52:18,720

hello yeah it's it's different stream

4648

02:52:21,910 --> 02:52:20,080

saying scream in the forest

4649

02:52:23,349 --> 02:52:21,920

hi is he where they are versus knocking

4650

02:52:25,670 --> 02:52:23,359

on someone's door

4651
02:52:27,269 --> 02:52:25,680
how do you p how would you pick uh the

4652
02:52:29,030 --> 02:52:27,279
star

4653
02:52:30,389 --> 02:52:29,040
what would you what would be your

4654
02:52:31,429 --> 02:52:30,399
criteria

4655
02:52:33,110 --> 02:52:31,439
it depends on whether or not you've

4656
02:52:34,630 --> 02:52:33,120
already detected them if i was an alien

4657
02:52:35,830 --> 02:52:34,640
and i was singing a complex message

4658
02:52:37,670 --> 02:52:35,840
maybe i've already detected their

4659
02:52:38,469 --> 02:52:37,680
civilization or that there's a inhabited

4660
02:52:39,830 --> 02:52:38,479
planet but

4661
02:52:41,190 --> 02:52:39,840
uh you're not really sending it to

4662
02:52:42,389 --> 02:52:41,200
individual stars at that point you're

4663
02:52:45,510 --> 02:52:42,399

saying to planets

4664

02:52:47,110 --> 02:52:45,520

uh because we should do that now yeah we

4665

02:52:49,269 --> 02:52:47,120

can do that now

4666

02:52:50,469 --> 02:52:49,279

and uh i'd said it to every single one i

4667

02:52:52,070 --> 02:52:50,479

mean if you're sitting with laser

4668

02:52:54,710 --> 02:52:52,080

send everybody the message once a day

4669

02:52:55,269 --> 02:52:54,720

for five seconds and and send to every

4670

02:52:57,190 --> 02:52:55,279

single

4671

02:52:59,110 --> 02:52:57,200

player in the galaxy it's pretty

4672

02:53:01,750 --> 02:52:59,120

fascinating that today

4673

02:53:03,030 --> 02:53:01,760

uh it's one thing to discover exoplanets

4674

02:53:06,710 --> 02:53:03,040

but now

4675

02:53:07,590 --> 02:53:06,720

we are uh especially in the last two

4676
02:53:10,710 --> 02:53:07,600
years

4677
02:53:13,349 --> 02:53:10,720
we've developed the ability to uh

4678
02:53:14,870 --> 02:53:13,359
look at atmosphere on these planets that

4679
02:53:16,790 --> 02:53:14,880
we can't see

4680
02:53:18,790 --> 02:53:16,800
that's pretty that's pretty fascinating

4681
02:53:20,469 --> 02:53:18,800
to me

4682
02:53:21,910 --> 02:53:20,479
and so on wavelengths scatter out for

4683
02:53:23,510 --> 02:53:21,920
certain types of molecules in certain

4684
02:53:25,110 --> 02:53:23,520
proportions you know so we we can tell

4685
02:53:27,030 --> 02:53:25,120
about the atmosphere from that

4686
02:53:28,630 --> 02:53:27,040
um so wavelengths should scatter more

4687
02:53:29,830 --> 02:53:28,640
off of land than they should

4688
02:53:31,110 --> 02:53:29,840

ocean so a certain amount of light

4689

02:53:32,870 --> 02:53:31,120

should be bouncing out the planet based

4690

02:53:34,150 --> 02:53:32,880

on how much it's torn that day so

4691

02:53:36,389 --> 02:53:34,160

again you should be able to tell the day

4692

02:53:38,469 --> 02:53:36,399

length only by seeing the just the

4693

02:53:39,750 --> 02:53:38,479

tiniest variation in how much light that

4694

02:53:41,110 --> 02:53:39,760

planet is giving off even though you

4695

02:53:42,309 --> 02:53:41,120

can't resolve anything about that planet

4696

02:53:44,389 --> 02:53:42,319

other than it's a blur

4697

02:53:47,190 --> 02:53:44,399

it's a blur whose brightness shifts

4698

02:53:49,990 --> 02:53:47,200

every 27.2 hours an hour

4699

02:53:51,030 --> 02:53:50,000

27.2 hour a day you can tell a lot from

4700

02:53:53,830 --> 02:53:51,040

a little pixel

4701
02:53:54,389 --> 02:53:53,840
now whatever i know i know it's just a

4702
02:53:56,950 --> 02:53:54,399
pixel

4703
02:53:58,790 --> 02:53:56,960
it's crazy but what about distance

4704
02:54:02,230 --> 02:53:58,800
though should we be looking at

4705
02:54:03,190 --> 02:54:02,240
the closest stars to us

4706
02:54:04,710 --> 02:54:03,200
we should be looking at the best

4707
02:54:05,990 --> 02:54:04,720
candidates but i mean if you're looking

4708
02:54:07,429 --> 02:54:06,000
to talk to somebody you should probably

4709
02:54:08,950 --> 02:54:07,439
try to talk to the folks closest to your

4710
02:54:10,230 --> 02:54:08,960
first because right so you can answer

4711
02:54:11,110 --> 02:54:10,240
back for them first and

4712
02:54:12,630 --> 02:54:11,120
they're the ones you really want to

4713
02:54:14,950 --> 02:54:12,640

establish a relationship with good or

4714

02:54:17,110 --> 02:54:14,960

nil early on

4715

02:54:18,950 --> 02:54:17,120

do you think that uh our first goal

4716

02:54:22,070 --> 02:54:18,960

should be alpha centauri

4717

02:54:23,190 --> 02:54:22,080

and that's that system uh well we

4718

02:54:24,870 --> 02:54:23,200

it's interesting is we don't actually

4719

02:54:25,990 --> 02:54:24,880

know if proxima centauri is part of the

4720

02:54:27,110 --> 02:54:26,000

alpha centauri system we've always

4721

02:54:30,309 --> 02:54:27,120

assumed it was but

4722

02:54:31,990 --> 02:54:30,319

uh um the first one to get there yeah

4723

02:54:33,510 --> 02:54:32,000

but why not but there's a lot of other

4724

02:54:35,750 --> 02:54:33,520

ones um

4725

02:54:37,269 --> 02:54:35,760

if you're going that distance you know

4726
02:54:39,030 --> 02:54:37,279
you go to the first place you can land

4727
02:54:40,230 --> 02:54:39,040
first but that's not necessarily that'll

4728
02:54:41,510 --> 02:54:40,240
be the closest you want to go the one

4729
02:54:42,950 --> 02:54:41,520
you can actually

4730
02:54:44,790 --> 02:54:42,960
we should travel to the first one we

4731
02:54:46,070 --> 02:54:44,800
find an exoplanet around that we

4732
02:54:47,990 --> 02:54:46,080
actually have a chance of setting up

4733
02:54:49,510 --> 02:54:48,000
shop on that's that that

4734
02:54:53,030 --> 02:54:49,520
might not be alpha centauri that might

4735
02:54:54,389 --> 02:54:53,040
be tau city i i remember uh

4736
02:54:56,309 --> 02:54:54,399
this is about a year and a half you

4737
02:54:58,710 --> 02:54:56,319
probably remember this

4738
02:55:00,710 --> 02:54:58,720

when the big news was proxima right oh

4739

02:55:04,070 --> 02:55:00,720

it's the right distance it's rocky and

4740

02:55:04,469 --> 02:55:04,080

uh you know we don't know if it's if

4741

02:55:07,110 --> 02:55:04,479

it's

4742

02:55:09,030 --> 02:55:07,120

rotating or if one side is exposed they

4743

02:55:10,309 --> 02:55:09,040

get real casual with what they say is

4744

02:55:12,550 --> 02:55:10,319

earthlings yeah right

4745

02:55:14,630 --> 02:55:12,560

right that is less like us than venus

4746

02:55:16,070 --> 02:55:14,640

and or you know that planet is neptune

4747

02:55:19,110 --> 02:55:16,080

and that's not what it like

4748

02:55:21,190 --> 02:55:19,120

and that yeah yeah exactly and uh

4749

02:55:22,230 --> 02:55:21,200

and so right after that announcement for

4750

02:55:25,670 --> 02:55:22,240

proxima

4751
02:55:27,510 --> 02:55:25,680
came out it got blasted with uh a plasma

4752
02:55:29,510 --> 02:55:27,520
burst and the entire planet was just

4753
02:55:31,910 --> 02:55:29,520
absolutely incinerated so any

4754
02:55:34,070 --> 02:55:31,920
hopes of now it's just a big chunk of

4755
02:55:36,550 --> 02:55:34,080
carbon

4756
02:55:37,910 --> 02:55:36,560
right do you remember that announcement

4757
02:55:41,030 --> 02:55:37,920
it was so funny

4758
02:55:46,070 --> 02:55:41,040
um oh man we're out of time

4759
02:55:51,110 --> 02:55:49,190
uh what's next are you in production now

4760
02:55:53,030 --> 02:55:51,120
oh yeah we have an episode uh i have to

4761
02:55:53,750 --> 02:55:53,040
get ready to prep for last uh tomorrow

4762
02:55:55,269 --> 02:55:53,760
it's uh

4763
02:55:56,790 --> 02:55:55,279

civilizations at the beginning of time

4764

02:55:58,150 --> 02:55:56,800

we're gonna try to figure out how early

4765

02:55:58,870 --> 02:55:58,160

life could have started this universe

4766

02:56:02,389 --> 02:55:58,880

and uh

4767

02:56:03,990 --> 02:56:02,399

you know running around through some

4768

02:56:05,269 --> 02:56:04,000

scenarios where i give you migrated to

4769

02:56:07,030 --> 02:56:05,279

another universe to escape the heat

4770

02:56:09,269 --> 02:56:07,040

death what that might look like so

4771

02:56:13,670 --> 02:56:09,279

well oh you know what i wanted to ask

4772

02:56:16,790 --> 02:56:13,680

let's see if we can squeeze this in um

4773

02:56:19,110 --> 02:56:16,800

do you think that we will overcome the

4774

02:56:21,429 --> 02:56:19,120

issues with mars do you think we will

4775

02:56:23,030 --> 02:56:21,439

colonize mars do we have a choice

4776
02:56:24,389 --> 02:56:23,040
i think we will just because we really

4777
02:56:26,389 --> 02:56:24,399
want to i don't think it's the best

4778
02:56:27,990 --> 02:56:26,399
candidate for colonization in many ways

4779
02:56:29,349 --> 02:56:28,000
venus is better or just a random

4780
02:56:31,750 --> 02:56:29,359
asteroid but

4781
02:56:32,950 --> 02:56:31,760
i think we will we want to we want to do

4782
02:56:39,190 --> 02:56:32,960
it so we're going to do it that's

4783
02:56:42,469 --> 02:56:41,429
our fascination with it is because it's

4784
02:56:45,030 --> 02:56:42,479
close

4785
02:56:45,750 --> 02:56:45,040
it kind of looks like earth right kind

4786
02:56:49,510 --> 02:56:45,760
of looks like

4787
02:56:51,429 --> 02:56:49,520
mountains it kind of stands not die yeah

4788
02:56:53,349 --> 02:56:51,439

you know it's almost you know i think

4789

02:56:55,030 --> 02:56:53,359

that's the fascination but the other

4790

02:56:55,830 --> 02:56:55,040

things that we have to overcome because

4791

02:56:59,429 --> 02:56:55,840

it's got a

4792

02:57:03,269 --> 02:56:59,439

no

4793

02:57:06,870 --> 02:57:03,279

protection uh from the sun really

4794

02:57:09,670 --> 02:57:06,880

uh the temperature is something that

4795

02:57:10,389 --> 02:57:09,680

really can't be overcome terraforming it

4796

02:57:13,590 --> 02:57:10,399

you know there's

4797

02:57:15,190 --> 02:57:13,600

all of these issues with mars i just

4798

02:57:17,269 --> 02:57:15,200

don't know if we will ever

4799

02:57:19,030 --> 02:57:17,279

you know like have cities there

4800

02:57:21,349 --> 02:57:19,040

colonized and antarctica will be

4801
02:57:23,030 --> 02:57:21,359
so but maybe we'll colonize antarctica

4802
02:57:23,990 --> 02:57:23,040
but it's just one of those things it's

4803
02:57:25,349 --> 02:57:24,000
going to be harder colonized in

4804
02:57:28,469 --> 02:57:25,359
antarctica

4805
02:57:31,269 --> 02:57:28,479
but okay so what what day of the week

4806
02:57:31,830 --> 02:57:31,279
do you uh publish the new shows thursday

4807
02:57:33,510 --> 02:57:31,840
mornings

4808
02:57:34,950 --> 02:57:33,520
we should have it out about uh well

4809
02:57:36,070 --> 02:57:34,960
usually about 9 00 a.m on

4810
02:57:37,750 --> 02:57:36,080
thursday mornings usually when the

4811
02:57:40,070 --> 02:57:37,760
episodes come out how many people are

4812
02:57:42,230 --> 02:57:40,080
involved with each production

4813
02:57:43,190 --> 02:57:42,240

oh well i mean fundamentally it's still

4814

02:57:45,349 --> 02:57:43,200

a show of one

4815

02:57:47,110 --> 02:57:45,359

but uh we've had the same cover artist

4816

02:57:49,349 --> 02:57:47,120

jacob grigo for uh for

4817

02:57:50,150 --> 02:57:49,359

four years now and there's a lot of

4818

02:57:51,510 --> 02:57:50,160

volunteers

4819

02:57:52,630 --> 02:57:51,520

and they come in the go on each getting

4820

02:57:53,990 --> 02:57:52,640

different project but there's at least

4821

02:57:55,269 --> 02:57:54,000

100 people i think we did the

4822

02:57:57,670 --> 02:57:55,279

end of the year thank you one had like

4823

02:57:59,110 --> 02:57:57,680

100 people in it so it's usually only

4824

02:57:59,670 --> 02:57:59,120

about five or six involved in a given

4825

02:58:02,630 --> 02:57:59,680

episode

4826
02:58:03,349 --> 02:58:02,640
yeah just fantastic uh congratulations

4827
02:58:06,070 --> 02:58:03,359
uh to

4828
02:58:06,389 --> 02:58:06,080
to your success you deserve all of it

4829
02:58:07,990 --> 02:58:06,399
and

4830
02:58:09,590 --> 02:58:08,000
uh just thank you so much what another

4831
02:58:11,429 --> 02:58:09,600
great conversation isaac

4832
02:58:13,110 --> 02:58:11,439
and uh just be safe out there wash your

4833
02:58:15,830 --> 02:58:13,120
hands wear a face mask

4834
02:58:18,150 --> 02:58:15,840
and uh let's uh get through 2021

4835
02:58:19,910 --> 02:58:18,160
together man thank you so much oh thanks

4836
02:58:23,309 --> 02:58:19,920
for having me on have a great week

4837
02:58:24,469 --> 02:58:23,319
you're the best isaac arthur now it's

4838
02:58:26,870 --> 02:58:24,479

isaacarthur.net

4839

02:58:27,830 --> 02:58:26,880

head over there all the youtube stuff

4840

02:58:31,190 --> 02:58:27,840

everything else

4841

02:58:33,670 --> 02:58:31,200

is is right there at isaacarthur.net

4842

02:58:35,110 --> 02:58:33,680

and that wraps poll to poll another

4843

02:58:38,309 --> 02:58:35,120

episode of fade to black

4844

02:58:40,070 --> 02:58:38,319

and tomorrow night is open lines

4845

02:58:41,830 --> 02:58:40,080

open lines tomorrow night's fader night

4846

02:58:44,790 --> 02:58:41,840

i am your host jimmy church

4847

02:58:45,510 --> 02:58:44,800

what a great i just enjoyed tonight and

4848

02:58:55,110 --> 02:58:45,520

i

4849

02:58:58,389 --> 02:58:55,120

are steve harter gene vettel mark d

4850

02:59:00,910 --> 02:58:58,399

kovar webmaster is drew the geek music

4851
02:59:02,469 --> 02:59:00,920
doug aldrich introspaceboy

4852
02:59:04,630 --> 02:59:02,479
spaceboymusic.com

4853
02:59:06,230 --> 02:59:04,640
painted black is produced by kjcr for

4854
02:59:07,750 --> 02:59:06,240
the game changer network and syndication

4855
02:59:09,910 --> 02:59:07,760
is kgra

4856
02:59:12,469 --> 02:59:09,920
the planet this broadcast owned

4857
02:59:14,630 --> 02:59:12,479
copyrighted 2021 by fade to black and

4858
02:59:16,630 --> 02:59:14,640
the game changer network inc

4859
02:59:18,150 --> 02:59:16,640
it cannot be re-broadcast downloaded

4860
02:59:18,870 --> 02:59:18,160
copied or used anywhere in the known

4861
02:59:20,550 --> 02:59:18,880
universe

4862
02:59:21,990 --> 02:59:20,560
without written permission from fade to

4863
02:59:23,190 --> 02:59:22,000

block of the game changer network i'm

4864

02:59:24,790 --> 02:59:23,200

your host jimmy church

4865

02:59:27,269 --> 02:59:24,800

i'll see everybody tomorrow night with

4866

02:59:28,630 --> 02:59:27,279

open lines it is fader night it is

4867

02:59:32,940 --> 02:59:28,640

thursday

4868

02:59:33,120 --> 02:59:32,950

until then everybody be safe fade to

4869

02:59:40,830 --> 02:59:33,130

[Applause]

4870

02:59:54,830 --> 02:59:43,740

block

4871

02:59:56,230 --> 02:59:54,840

[Music]