



**CARLO
ROVELLI**

**TIME
IS AN
ILLUSION**

1
00:00:04,070 --> 00:00:01,990
carlo ravelli is a world-renowned

2
00:00:06,550 --> 00:00:04,080
theoretical physicist and is one of the

3
00:00:08,390 --> 00:00:06,560
main developers of loop quantum gravity

4
00:00:10,150 --> 00:00:08,400
the main academic competitor to string

5
00:00:11,749 --> 00:00:10,160
theory click on the time stamp in the

6
00:00:13,669 --> 00:00:11,759
description if you'd like to skip this

7
00:00:15,749 --> 00:00:13,679
intro it's rare that i feel such a

8
00:00:17,269 --> 00:00:15,759
connection with someone from the get-go

9
00:00:19,830 --> 00:00:17,279
and i hope that you can feel the warmth

10
00:00:21,670 --> 00:00:19,840
of the relation between us as well today

11
00:00:23,429 --> 00:00:21,680
speaking of relations we cover the

12
00:00:25,029 --> 00:00:23,439
argument that relations are more

13
00:00:27,349 --> 00:00:25,039

fundamental than that which is being

14

00:00:29,109 --> 00:00:27,359

related we also cover the only two

15

00:00:31,109 --> 00:00:29,119

interpretations of quantum mechanics

16

00:00:33,190 --> 00:00:31,119

that are consistent at least according

17

00:00:35,750 --> 00:00:33,200

to carlo the nature of time and its

18

00:00:38,150 --> 00:00:35,760

ostensible arrow as well as how science

19

00:00:40,630 --> 00:00:38,160

supervenies on what's decidedly not

20

00:00:42,709 --> 00:00:40,640

scientific per se that is a largely

21

00:00:44,389 --> 00:00:42,719

philosophical conversation there's only

22

00:00:46,310 --> 00:00:44,399

been one book that i've consistently

23

00:00:48,310 --> 00:00:46,320

recommended on this channel and that is

24

00:00:50,869 --> 00:00:48,320

ian mcgill christ's master and his

25

00:00:53,590 --> 00:00:50,879

emissary and now i'm adding a second and

26

00:00:55,110 --> 00:00:53,600

that's carlo rivelli's order of time

27

00:00:57,110 --> 00:00:55,120

links to both of those will be in the

28

00:00:58,470 --> 00:00:57,120

description for those of you who are new

29

00:01:00,229 --> 00:00:58,480

to this channel my name is kurt

30

00:01:02,069 --> 00:01:00,239

jaimungle i'm a filmmaker with a

31

00:01:03,990 --> 00:01:02,079

background in mathematical physics

32

00:01:06,230 --> 00:01:04,000

dedicated to the explication of what are

33

00:01:08,310 --> 00:01:06,240

called theories of everything from a

34

00:01:09,910 --> 00:01:08,320

theoretical physics perspective but as

35

00:01:11,510 --> 00:01:09,920

well as delineating the possible

36

00:01:13,590 --> 00:01:11,520

connection consciousness has to the

37

00:01:15,830 --> 00:01:13,600

fundamental laws of nature provided

38

00:01:18,710 --> 00:01:15,840

these laws exist at all and are knowable

39

00:01:20,789 --> 00:01:18,720

to us if you enjoy witnessing and or

40

00:01:22,870 --> 00:01:20,799

engaging in real-time conversation with

41

00:01:25,910 --> 00:01:22,880

others on the topics of psychology

42

00:01:28,789 --> 00:01:25,920

neurobiology physics consciousness free

43

00:01:30,789 --> 00:01:28,799

will god and so on then do visit the

44

00:01:32,710 --> 00:01:30,799

discord and the subreddit the links for

45

00:01:34,310 --> 00:01:32,720

those are in the description there's

46

00:01:37,350 --> 00:01:34,320

also a link to the patreon in the

47

00:01:39,670 --> 00:01:37,360

description that is patreon.com

48

00:01:41,510 --> 00:01:39,680

kurt jaimungle as the patrons and the

49

00:01:43,350 --> 00:01:41,520

sponsors are the only reason i'm able to

50

00:01:45,270 --> 00:01:43,360

do this full time it would be near

51
00:01:47,350 --> 00:01:45,280
impossible for me to have conversations

52
00:01:49,830 --> 00:01:47,360
like this with any fidelity with any

53
00:01:52,149 --> 00:01:49,840
depth on topics like consciousness loop

54
00:01:54,230 --> 00:01:52,159
quantum gravity geometric unity that's

55
00:01:57,030 --> 00:01:54,240
coming up string theory non-neural

56
00:01:59,510 --> 00:01:57,040
bioelectric manipulation and so on if

57
00:02:01,030 --> 00:01:59,520
not for the patrons and the sponsors

58
00:02:04,310 --> 00:02:01,040
thank you and again that link is

59
00:02:06,789 --> 00:02:04,320
patreon.com kirchheim uncle speaking of

60
00:02:09,510 --> 00:02:06,799
sponsors there are two the first sponsor

61
00:02:12,070 --> 00:02:09,520
is algo algo is an end-to-end supply

62
00:02:13,670 --> 00:02:12,080
chain optimization software company with

63
00:02:15,910 --> 00:02:13,680

software that helps business users

64

00:02:18,150 --> 00:02:15,920

optimize sales and operations planning

65

00:02:20,150 --> 00:02:18,160

to avoid stockouts reduce returns and

66

00:02:22,390 --> 00:02:20,160

inventory write downs while reducing

67

00:02:25,350 --> 00:02:22,400

inventory investment it's a supply chain

68

00:02:27,270 --> 00:02:25,360

ai that drives smart roi headed by amjad

69

00:02:29,589 --> 00:02:27,280

hussein who's been a huge supporter of

70

00:02:31,990 --> 00:02:29,599

this podcast since near its inception

71

00:02:33,270 --> 00:02:32,000

now omdat has a podcast on ai in

72

00:02:35,030 --> 00:02:33,280

consciousness and if you'd like to

73

00:02:36,470 --> 00:02:35,040

support this channel that is the tow

74

00:02:38,390 --> 00:02:36,480

channel then please visit the

75

00:02:40,869 --> 00:02:38,400

description and support his channel as

76

00:02:42,949 --> 00:02:40,879

doing so supports this indirectly the

77

00:02:45,270 --> 00:02:42,959

second sponsor is brilliant brilliance

78

00:02:47,030 --> 00:02:45,280

illuminates the soul of mathematics

79

00:02:48,710 --> 00:02:47,040

science and engineering through these

80

00:02:51,350 --> 00:02:48,720

bite-sized interactive learning

81

00:02:53,430 --> 00:02:51,360

experiences brilliance courses explore

82

00:02:55,110 --> 00:02:53,440

the laws that shape our world it

83

00:02:57,670 --> 00:02:55,120

elevates math and science from something

84

00:02:59,830 --> 00:02:57,680

to be feared to a delightful experience

85

00:03:01,430 --> 00:02:59,840

of guided discovery you can even learn

86

00:03:03,030 --> 00:03:01,440

group theory which is what's being

87

00:03:05,509 --> 00:03:03,040

referenced when you hear that the

88

00:03:08,309 --> 00:03:05,519

standard model is contingent on u1 cross

89

00:03:09,750 --> 00:03:08,319

su-2 cross su-3 those are technically

90

00:03:13,110 --> 00:03:09,760

called lead groups and those are local

91

00:03:15,430 --> 00:03:13,120

symmetries visit brilliant.org toe that

92

00:03:16,949 --> 00:03:15,440

is t-o-e and i think you'll be greatly

93

00:03:19,030 --> 00:03:16,959

surprised at the ease at which you can

94

00:03:21,350 --> 00:03:19,040

comprehend subjects you had previously

95

00:03:23,910 --> 00:03:21,360

had a difficult time grocking don't stop

96

00:03:26,550 --> 00:03:23,920

before four lessons thank you and enjoy

97

00:03:29,190 --> 00:03:26,560

this curiously metaphysical conversation

98

00:03:32,869 --> 00:03:29,200

with carlo revelli yeah when you asked

99

00:03:35,110 --> 00:03:32,879

me i looked i i decided to watch one

100

00:03:37,190 --> 00:03:35,120

and then i said i liked it oh thank you

101
00:03:38,710 --> 00:03:37,200
my physicist i knew i think but i

102
00:03:41,750 --> 00:03:38,720
appreciate the

103
00:03:44,789 --> 00:03:41,760
the width of your the the

104
00:03:47,270 --> 00:03:44,799
um of your questions and uh

105
00:03:49,110 --> 00:03:47,280
and the fact that you went uh very

106
00:03:50,390 --> 00:03:49,120
detailed but you know

107
00:03:51,270 --> 00:03:50,400
a good uh

108
00:03:52,470 --> 00:03:51,280
uh

109
00:03:55,270 --> 00:03:52,480
um

110
00:03:56,869 --> 00:03:55,280
uh middle ground so you you seem to know

111
00:04:00,949 --> 00:03:56,879
what you were talking about yeah i seem

112
00:04:03,350 --> 00:04:00,959
to i'm great at pretending

113
00:04:04,949 --> 00:04:03,360

so professor why don't you explain your

114

00:04:07,270 --> 00:04:04,959

relational view your interpretation of

115

00:04:09,350 --> 00:04:07,280

quantum mechanics

116

00:04:11,350 --> 00:04:09,360

uh wonderful thank you kurt for for

117

00:04:12,949 --> 00:04:11,360

having me here uh first of all please

118

00:04:15,270 --> 00:04:12,959

don't call me professor everybody calls

119

00:04:17,509 --> 00:04:15,280

me carlo and that's how i feel

120

00:04:21,509 --> 00:04:17,519

comfortable with

121

00:04:25,110 --> 00:04:21,519

right so relational quantum mechanics is

122

00:04:26,070 --> 00:04:25,120

um the way i think

123

00:04:30,310 --> 00:04:26,080

it's

124

00:04:31,990 --> 00:04:30,320

understand quantum mechanics there are

125

00:04:34,790 --> 00:04:32,000

as you know kurt there are a number of

126

00:04:36,230 --> 00:04:34,800

uh interpretations of quantum mechanics

127

00:04:39,430 --> 00:04:36,240

out there

128

00:04:42,150 --> 00:04:39,440

i find them all interesting um i think

129

00:04:43,749 --> 00:04:42,160

that none of them it's wrong um i think

130

00:04:45,590 --> 00:04:43,759

they're all each one

131

00:04:48,710 --> 00:04:45,600

is right

132

00:04:50,950 --> 00:04:48,720

but each one has a cost a price to pay

133

00:04:53,189 --> 00:04:50,960

and the question is uh are we ready to

134

00:04:54,790 --> 00:04:53,199

pay this price is it useful to pay this

135

00:04:56,469 --> 00:04:54,800

price to to go ahead and better

136

00:04:57,990 --> 00:04:56,479

understand the world

137

00:04:59,510 --> 00:04:58,000

and uh

138

00:05:01,029 --> 00:04:59,520

i think the the relation quantum

139

00:05:03,430 --> 00:05:01,039

mechanics which i'm gonna describe in a

140

00:05:04,390 --> 00:05:03,440

moment uh uh also have a price like

141

00:05:06,710 --> 00:05:04,400

everything

142

00:05:08,870 --> 00:05:06,720

a philosophical price okay

143

00:05:11,029 --> 00:05:08,880

uh but i think it's the best price to

144

00:05:12,950 --> 00:05:11,039

pace if we if we buy that then we

145

00:05:14,790 --> 00:05:12,960

understand the world better

146

00:05:16,469 --> 00:05:14,800

um

147

00:05:22,390 --> 00:05:16,479

the

148

00:05:25,590 --> 00:05:22,400

can be expressed in different manners um

149

00:05:28,629 --> 00:05:25,600

one way of of of presenting it is that

150

00:05:30,870 --> 00:05:28,639

what the what the theory gives us

151

00:05:32,950 --> 00:05:30,880

is what we see when we look when we see

152

00:05:34,950 --> 00:05:32,960

when we measure it give predictions for

153

00:05:36,870 --> 00:05:34,960

measurement

154

00:05:39,830 --> 00:05:36,880

uh and that's the way it's it's uh it's

155

00:05:41,350 --> 00:05:39,840

formulated in in textbooks uh

156

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

the textbook quantum mechanic talks

157

00:05:45,430 --> 00:05:42,960

about the observer we talk about the

158

00:05:46,550 --> 00:05:45,440

measurement apparatus they talk about uh

159

00:05:48,629 --> 00:05:46,560

um

160

00:05:50,550 --> 00:05:48,639

about the outcome of the

161

00:05:51,430 --> 00:05:50,560

of the measurement

162

00:05:53,670 --> 00:05:51,440

now

163

00:05:54,870 --> 00:05:53,680

uh this is okay if you want to use it in

164

00:05:57,510 --> 00:05:54,880

fact a lot of people use quantum

165

00:05:59,430 --> 00:05:57,520

mechanics in these terms and uh very

166

00:06:02,230 --> 00:05:59,440

happy period there's no no question

167

00:06:03,990 --> 00:06:02,240

after that but of course it's not okay

168

00:06:05,830 --> 00:06:04,000

uh if we

169

00:06:08,469 --> 00:06:05,840

after we've realized quantum mechanics

170

00:06:10,710 --> 00:06:08,479

100 years old after we've realized that

171

00:06:12,550 --> 00:06:10,720

uh uh quantum mechanics is actually the

172

00:06:15,830 --> 00:06:12,560

best thing we have for everything for

173

00:06:17,749 --> 00:06:15,840

galaxies for star for for

174

00:06:19,510 --> 00:06:17,759

structure formation in the universe for

175

00:06:21,350 --> 00:06:19,520

what happened inside the sun

176

00:06:22,390 --> 00:06:21,360

so it's it's how we want to think about

177

00:06:24,070 --> 00:06:22,400

the world

178

00:06:25,990 --> 00:06:24,080

at the

179

00:06:28,150 --> 00:06:26,000

most fundamental physical level that we

180

00:06:29,189 --> 00:06:28,160

have access today

181

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

and then

182

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

what the hell is an apparatus

183

00:06:36,309 --> 00:06:33,440

and an observer doing into that there

184

00:06:38,870 --> 00:06:36,319

are no observers in the sun or or in the

185

00:06:42,230 --> 00:06:38,880

early universe when star formed

186

00:06:44,230 --> 00:06:42,240

so something is missing obviously in the

187

00:06:46,309 --> 00:06:44,240

standard textbook presentation of

188

00:06:49,749 --> 00:06:46,319

quantum mechanics which is who is

189

00:06:50,950 --> 00:06:49,759

observed uh what what is a major what is

190

00:06:53,830 --> 00:06:50,960

a measurement

191

00:06:55,830 --> 00:06:53,840

and one way of saying that is that uh in

192

00:06:57,990 --> 00:06:55,840

the in the in the standard presentation

193

00:07:00,070 --> 00:06:58,000

of quantum mechanics there are two

194

00:07:02,309 --> 00:07:00,080

postulates two assumptions

195

00:07:05,589 --> 00:07:02,319

which appear to be contradictory to one

196

00:07:08,309 --> 00:07:05,599

another one is that um if you don't look

197

00:07:10,150 --> 00:07:08,319

you have a quantum system it evolves in

198

00:07:11,670 --> 00:07:10,160

a way uh which is described by the

199

00:07:13,189 --> 00:07:11,680

schrodinger equation or by unitary

200

00:07:14,469 --> 00:07:13,199

evolution

201
00:07:17,029 --> 00:07:14,479
things change

202
00:07:18,550 --> 00:07:17,039
if you look there is a different

203
00:07:21,189 --> 00:07:18,560
postulate which is a projection

204
00:07:24,309 --> 00:07:21,199
postulate that says that the state does

205
00:07:25,749 --> 00:07:24,319
not evolve schrodinger evolution but it

206
00:07:28,469 --> 00:07:25,759
just jumps

207
00:07:29,589 --> 00:07:28,479
um and the visual way of viewing this is

208
00:07:32,469 --> 00:07:29,599
that

209
00:07:34,629 --> 00:07:32,479
a particle uh like an electron is

210
00:07:36,390 --> 00:07:34,639
described like a wave

211
00:07:38,950 --> 00:07:36,400
that satisfies the schradring equations a

212
00:07:41,029 --> 00:07:38,960
wave diffuses in space when you look at

213
00:07:42,950 --> 00:07:41,039

it you see in a point so the wave

214

00:07:44,629 --> 00:07:42,960

collapses in a point

215

00:07:45,830 --> 00:07:44,639

and when does it collapses when there's

216

00:07:49,830 --> 00:07:45,840

a measurement

217

00:07:51,510 --> 00:07:49,840

and a parameters

218

00:07:52,230 --> 00:07:51,520

uh measure it

219

00:07:54,230 --> 00:07:52,240

but

220

00:07:58,869 --> 00:07:54,240

there are no observers a parata inside

221

00:08:00,869 --> 00:07:58,879

the sun no observer apparata inside the

222

00:08:02,629 --> 00:08:00,879

distant galaxy or

223

00:08:04,950 --> 00:08:02,639

in all the cases we use quantum

224

00:08:06,150 --> 00:08:04,960

mechanics so that's the problem

225

00:08:07,110 --> 00:08:06,160

and

226

00:08:09,990 --> 00:08:07,120

there are

227

00:08:13,110 --> 00:08:10,000

many solutions on the table um some

228

00:08:15,350 --> 00:08:13,120

people think that uh you know

229

00:08:17,270 --> 00:08:15,360

it's always waves so the particle never

230

00:08:19,110 --> 00:08:17,280

goes to a point and the

231

00:08:21,350 --> 00:08:19,120

reality will happen is that we are self

232

00:08:22,950 --> 00:08:21,360

waves and we split in many different

233

00:08:24,309 --> 00:08:22,960

copies of ourselves this is many world

234

00:08:26,390 --> 00:08:24,319

interpretation

235

00:08:28,469 --> 00:08:26,400

and others

236

00:08:30,869 --> 00:08:28,479

now the relational

237

00:08:32,469 --> 00:08:30,879

and i'll finally come to you to your

238

00:08:34,709 --> 00:08:32,479

question the relational interpretation

239

00:08:37,110 --> 00:08:34,719

is idea that we can make sense of that

240

00:08:39,589 --> 00:08:37,120

by simply thinking

241

00:08:41,269 --> 00:08:39,599

that what happens between the particle

242

00:08:44,149 --> 00:08:41,279

and the observer

243

00:08:46,230 --> 00:08:44,159

the particle and the measurement parata

244

00:08:48,470 --> 00:08:46,240

is generic and it's not because of

245

00:08:50,150 --> 00:08:48,480

special property of the server or the

246

00:08:51,590 --> 00:08:50,160

measuring apparatus just what happened

247

00:08:54,310 --> 00:08:51,600

between any

248

00:08:55,910 --> 00:08:54,320

system and any other system in the

249

00:08:58,470 --> 00:08:55,920

universe

250

00:09:01,030 --> 00:08:58,480

so every time two systems we describe

251
00:09:03,829 --> 00:09:01,040
the world uh by splitting it in systems

252
00:09:05,670 --> 00:09:03,839
physical systems like the sun like a

253
00:09:08,070 --> 00:09:05,680
particle the molecule

254
00:09:09,110 --> 00:09:08,080
uh the earth uh you me these are all

255
00:09:12,150 --> 00:09:09,120
systems

256
00:09:14,150 --> 00:09:12,160
from the perspective of physicists

257
00:09:16,550 --> 00:09:14,160
every time two of these interact so

258
00:09:17,430 --> 00:09:16,560
exchange something

259
00:09:20,630 --> 00:09:17,440
uh

260
00:09:23,269 --> 00:09:20,640
one so to say measure the other

261
00:09:25,509 --> 00:09:23,279
so if this is a particle

262
00:09:28,230 --> 00:09:25,519
when it interact with me the particle

263
00:09:29,509 --> 00:09:28,240

collapses in a point has a position

264

00:09:31,110 --> 00:09:29,519

okay

265

00:09:32,790 --> 00:09:31,120

but

266

00:09:34,949 --> 00:09:32,800

this is not true

267

00:09:36,870 --> 00:09:34,959

this is only true the positive particles

268

00:09:38,550 --> 00:09:36,880

of pollution only with respect to this

269

00:09:40,630 --> 00:09:38,560

system not with respect to the rest of

270

00:09:45,269 --> 00:09:40,640

the universe

271

00:09:47,910 --> 00:09:45,279

it's uh uh

272

00:09:51,350 --> 00:09:47,920

it's uh it's later interacting with a

273

00:09:53,829 --> 00:09:51,360

particle and this observer here

274

00:09:55,670 --> 00:09:53,839

doesn't have to take into account this

275

00:10:00,389 --> 00:09:55,680

collapse

276

00:10:02,389 --> 00:10:00,399

evolution are always both true

277

00:10:03,350 --> 00:10:02,399

good postulate for describing what

278

00:10:05,430 --> 00:10:03,360

happened

279

00:10:06,870 --> 00:10:05,440

in the universe you just refer

280

00:10:08,069 --> 00:10:06,880

to different

281

00:10:10,389 --> 00:10:08,079

systems

282

00:10:12,310 --> 00:10:10,399

the ones which are directly interacting

283

00:10:14,150 --> 00:10:12,320

what is relevant is a projector

284

00:10:16,870 --> 00:10:14,160

postulate the ones which are not

285

00:10:18,470 --> 00:10:16,880

involved interacting which still

286

00:10:20,310 --> 00:10:18,480

may have an interesting of you know

287

00:10:22,630 --> 00:10:20,320

computing what's going to happen next in

288

00:10:23,509 --> 00:10:22,640

the interaction to them

289

00:10:25,030 --> 00:10:23,519

um

290

00:10:27,190 --> 00:10:25,040

for them is relevant to unitary

291

00:10:27,910 --> 00:10:27,200

evolution postulate

292

00:10:28,790 --> 00:10:27,920

so

293

00:10:31,590 --> 00:10:28,800

the

294

00:10:33,350 --> 00:10:31,600

this is it i mean this solves completely

295

00:10:34,870 --> 00:10:33,360

the quantum mechanical problems because

296

00:10:37,110 --> 00:10:34,880

uh

297

00:10:38,550 --> 00:10:37,120

now we know what is a what is a system

298

00:10:40,230 --> 00:10:38,560

and now what is an observer nothing

299

00:10:42,630 --> 00:10:40,240

special all systems are

300

00:10:44,550 --> 00:10:42,640

systems all system observable

301
00:10:47,269 --> 00:10:44,560
and now we know when to use one poster

302
00:10:50,069 --> 00:10:47,279
than the other

303
00:10:51,670 --> 00:10:50,079
the price to pay is that the practical

304
00:10:53,829 --> 00:10:51,680
being in a position

305
00:10:55,750 --> 00:10:53,839
it's only relative to the system it has

306
00:10:57,110 --> 00:10:55,760
interacted with not relevant to

307
00:10:59,190 --> 00:10:57,120
something else with respect to something

308
00:11:01,110 --> 00:10:59,200
else is still spread around still a wave

309
00:11:01,910 --> 00:11:01,120
everywhere

310
00:11:04,550 --> 00:11:01,920
so

311
00:11:07,430 --> 00:11:04,560
all the variable taken values always

312
00:11:08,710 --> 00:11:07,440
relative relative to a system

313
00:11:10,790 --> 00:11:08,720

so this means

314

00:11:13,350 --> 00:11:10,800

that when we describe the world

315

00:11:15,829 --> 00:11:13,360

uh we describe the world

316

00:11:17,910 --> 00:11:15,839

giving values to variable i means

317

00:11:19,350 --> 00:11:17,920

microphone is here that color on the

318

00:11:22,389 --> 00:11:19,360

screen is red

319

00:11:24,310 --> 00:11:22,399

you know the sun is there these are all

320

00:11:26,310 --> 00:11:24,320

variables that

321

00:11:28,150 --> 00:11:26,320

values the variables take

322

00:11:29,990 --> 00:11:28,160

the color the position

323

00:11:32,550 --> 00:11:30,000

etc

324

00:11:34,389 --> 00:11:32,560

these if you if you buy the relational

325

00:11:36,310 --> 00:11:34,399

interpretation of quantum mechanics they

326

00:11:38,069 --> 00:11:36,320

are not absolute

327

00:11:39,670 --> 00:11:38,079

properties of a system

328

00:11:42,389 --> 00:11:39,680

they are properly the system respect to

329

00:11:43,750 --> 00:11:42,399

me or with respect to this chair not me

330

00:11:46,150 --> 00:11:43,760

as a human being

331

00:11:48,470 --> 00:11:46,160

me as a physical system

332

00:11:49,990 --> 00:11:48,480

so that's a religion relational because

333

00:11:52,710 --> 00:11:50,000

uh

334

00:11:54,550 --> 00:11:52,720

the suggestion here is don't think

335

00:11:55,350 --> 00:11:54,560

at reality

336

00:11:57,670 --> 00:11:55,360

as

337

00:11:58,629 --> 00:11:57,680

systems with properties

338

00:12:00,230 --> 00:11:58,639

rather

339

00:12:02,150 --> 00:12:00,240

think of reality

340

00:12:03,750 --> 00:12:02,160

as a system that

341

00:12:05,509 --> 00:12:03,760

have properties where they interact with

342

00:12:08,069 --> 00:12:05,519

something else only when they interact

343

00:12:10,389 --> 00:12:08,079

with something else and relatively to

344

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

this something else

345

00:12:14,310 --> 00:12:12,720

that's a solution a possible solution of

346

00:12:15,670 --> 00:12:14,320

the quantum mechanic

347

00:12:16,470 --> 00:12:15,680

puzzle

348

00:12:19,030 --> 00:12:16,480

um

349

00:12:19,910 --> 00:12:19,040

the cost of this is accepting

350

00:12:22,629 --> 00:12:19,920

uh

351

00:12:24,870 --> 00:12:22,639

this weakened realism so to say the

352

00:12:25,990 --> 00:12:24,880

world is not made by a substance with

353

00:12:29,430 --> 00:12:26,000

properties

354

00:12:30,949 --> 00:12:29,440

it's made by interacting pieces

355

00:12:33,350 --> 00:12:30,959

and the pieces have properties only with

356

00:12:35,190 --> 00:12:33,360

interact

357

00:12:37,350 --> 00:12:35,200

okay so firstly let's remove the word

358

00:12:39,910 --> 00:12:37,360

observer and say interaction because

359

00:12:41,910 --> 00:12:39,920

observer seems to imply in people's mind

360

00:12:43,430 --> 00:12:41,920

a human being essentially or something

361

00:12:45,190 --> 00:12:43,440

conscious

362

00:12:47,030 --> 00:12:45,200

okay exactly

363

00:12:48,949 --> 00:12:47,040

so there's that and then

364

00:12:50,470 --> 00:12:48,959

what i'm wondering is let's say so i

365

00:12:51,509 --> 00:12:50,480

have a bedroom here and i don't know

366

00:12:52,949 --> 00:12:51,519

what's going on pretend it's much

367

00:12:54,710 --> 00:12:52,959

farther away and i haven't interacted

368

00:12:56,470 --> 00:12:54,720

with it so something's going on in that

369

00:12:58,310 --> 00:12:56,480

bedroom now to those people who are

370

00:12:59,509 --> 00:12:58,320

interacting in this bedroom right now

371

00:13:02,949 --> 00:12:59,519

they're

372

00:13:05,430 --> 00:13:02,959

they've collapsed their wave function in

373

00:13:06,790 --> 00:13:05,440

a sense okay that's good is there and

374

00:13:08,150 --> 00:13:06,800

let's say they've come up with some

375

00:13:09,509 --> 00:13:08,160

value and that says

376

00:13:11,829 --> 00:13:09,519

it could be a or b and they've come up

377

00:13:13,990 --> 00:13:11,839

with value a for some like the heads

378

00:13:15,910 --> 00:13:14,000

heads on a coin now is there a reason

379

00:13:17,990 --> 00:13:15,920

that necessarily if i was to interact

380

00:13:20,870 --> 00:13:18,000

with them that it consistently comes up

381

00:13:25,509 --> 00:13:20,880

with the same answer

382

00:13:28,550 --> 00:13:27,509

um

383

00:13:30,389 --> 00:13:28,560

good

384

00:13:31,910 --> 00:13:30,399

uh

385

00:13:36,949 --> 00:13:31,920

yes

386

00:13:41,350 --> 00:13:38,710

but but one has

387

00:13:42,790 --> 00:13:41,360

has to be careful in in formulating

388

00:13:43,990 --> 00:13:42,800

things properly

389

00:13:45,030 --> 00:13:44,000

properly

390

00:13:46,310 --> 00:13:45,040

namely

391

00:13:49,509 --> 00:13:46,320

um

392

00:13:52,230 --> 00:13:49,519

if you uh

393

00:13:52,949 --> 00:13:52,240

let's see exactly what what it means

394

00:13:55,189 --> 00:13:52,959

uh

395

00:13:58,069 --> 00:13:55,199

suppose you yourself measure that

396

00:14:00,949 --> 00:13:58,079

property and and you found a

397

00:14:05,110 --> 00:14:00,959

and then you interact with them

398

00:14:06,470 --> 00:14:05,120

and ask them hey what have you seen

399

00:14:09,509 --> 00:14:06,480

then for sure

400

00:14:10,949 --> 00:14:09,519

you would get something consistent

401
00:14:13,430 --> 00:14:10,959
uh

402
00:14:15,430 --> 00:14:13,440
this is the precise meaning of

403
00:14:17,590 --> 00:14:15,440
seeing the same thing

404
00:14:19,509 --> 00:14:17,600
in other words

405
00:14:23,430 --> 00:14:19,519
you can compare what

406
00:14:26,389 --> 00:14:23,440
what you have seen and what the the

407
00:14:27,509 --> 00:14:26,399
the people in the room have

408
00:14:30,150 --> 00:14:27,519
seen

409
00:14:33,509 --> 00:14:30,160
by talking to them or by asking them or

410
00:14:37,670 --> 00:14:36,389
but this interaction is quite mechanical

411
00:14:39,750 --> 00:14:37,680
so

412
00:14:41,350 --> 00:14:39,760
this interaction is

413
00:14:43,670 --> 00:14:41,360

itself a physical interaction not

414

00:14:45,670 --> 00:14:43,680

outside physics you cannot out go

415

00:14:47,670 --> 00:14:45,680

outside the world and somehow

416

00:14:49,750 --> 00:14:47,680

uh

417

00:14:51,750 --> 00:14:49,760

cheat physics circumvent and say oh

418

00:14:53,509 --> 00:14:51,760

physics is not looking let me ask you

419

00:14:54,870 --> 00:14:53,519

what you've seen that's you cannot do

420

00:14:56,389 --> 00:14:54,880

that's the point

421

00:14:59,030 --> 00:14:56,399

so um

422

00:15:01,189 --> 00:14:59,040

yes there is consistency and why i am so

423

00:15:03,269 --> 00:15:01,199

careful in saying that

424

00:15:05,269 --> 00:15:03,279

because uh quantum mechanics is tricky

425

00:15:06,550 --> 00:15:05,279

as you know if you measure the position

426
00:15:09,670 --> 00:15:06,560
of a particle then they measure the

427
00:15:11,509 --> 00:15:09,680
momentum you destroy

428
00:15:13,430 --> 00:15:11,519
the information about the position

429
00:15:15,750 --> 00:15:13,440
immediately after you measure the

430
00:15:17,590 --> 00:15:15,760
position again it's not the previous one

431
00:15:19,590 --> 00:15:17,600
so but measure the momentum the position

432
00:15:21,350 --> 00:15:19,600
is affected

433
00:15:23,590 --> 00:15:21,360
so you have to be careful because if you

434
00:15:25,829 --> 00:15:23,600
ask these people a question which is

435
00:15:28,550 --> 00:15:25,839
like the momentum toward the position

436
00:15:29,509 --> 00:15:28,560
you might be destroying

437
00:15:30,310 --> 00:15:29,519
uh

438
00:15:33,430 --> 00:15:30,320

some

439

00:15:37,189 --> 00:15:34,949

of the properties

440

00:15:39,509 --> 00:15:37,199

and it might be

441

00:15:43,030 --> 00:15:39,519

therefore

442

00:15:44,470 --> 00:15:43,040

neither true nor false that the value

443

00:15:45,990 --> 00:15:44,480

is a

444

00:15:48,069 --> 00:15:46,000

like when you

445

00:15:49,430 --> 00:15:48,079

when you do a double slit interference

446

00:15:51,030 --> 00:15:49,440

if you measure the interference you

447

00:15:52,870 --> 00:15:51,040

cannot ask anymore which way the

448

00:15:55,269 --> 00:15:52,880

particle has gone through which slip the

449

00:15:56,629 --> 00:15:55,279

particle has gone to so by asking when

450

00:15:57,749 --> 00:15:56,639

there is no answer to the one to the

451
00:15:59,829 --> 00:15:57,759
other one

452
00:16:01,189 --> 00:15:59,839
so

453
00:16:03,430 --> 00:16:01,199
the point is that when you when you

454
00:16:05,269 --> 00:16:03,440
compare what two different observables

455
00:16:07,509 --> 00:16:05,279
have seen you have to be careful that

456
00:16:11,910 --> 00:16:07,519
there are these interference effects

457
00:16:15,829 --> 00:16:12,550
a

458
00:16:21,189 --> 00:16:18,230
my in my block the possibility of

459
00:16:24,310 --> 00:16:21,199
identifying exactly what what the two

460
00:16:25,430 --> 00:16:24,320
have seen so as long as you keep asking

461
00:16:26,310 --> 00:16:25,440
questions

462
00:16:28,230 --> 00:16:26,320
uh

463
00:16:29,910 --> 00:16:28,240

which are not like position moment that

464

00:16:31,590 --> 00:16:29,920

don't destroy previous information

465

00:16:36,949 --> 00:16:31,600

everything is consistent every observer

466

00:16:40,150 --> 00:16:38,790

with regard to these relations i've

467

00:16:41,910 --> 00:16:40,160

heard you say quite a few times

468

00:16:45,350 --> 00:16:41,920

relations are what are more fundamental

469

00:16:47,509 --> 00:16:45,360

than the things itself

470

00:16:49,110 --> 00:16:47,519

however to me as i'm having a difficult

471

00:16:51,910 --> 00:16:49,120

time understanding that because to me a

472

00:16:54,230 --> 00:16:51,920

relation presupposes things you can't

473

00:16:55,829 --> 00:16:54,240

have a relation without having things to

474

00:16:58,150 --> 00:16:55,839

have a relationship with unless you have

475

00:17:00,550 --> 00:16:58,160

a relation between relations and then it

476

00:17:02,230 --> 00:17:00,560

just keeps occurring infinitely

477

00:17:07,189 --> 00:17:02,240

so

478

00:17:09,110 --> 00:17:07,199

relationships as fundamental

479

00:17:10,949 --> 00:17:09,120

see even mathematically the way that i'm

480

00:17:12,549 --> 00:17:10,959

thinking about this right now in model

481

00:17:13,909 --> 00:17:12,559

theory you have a signature and then

482

00:17:15,829 --> 00:17:13,919

relations

483

00:17:18,230 --> 00:17:15,839

you need an arity functions like how

484

00:17:19,990 --> 00:17:18,240

many are are going to be compared how

485

00:17:21,750 --> 00:17:20,000

and then what is being compared are i

486

00:17:25,590 --> 00:17:21,760

would call the things

487

00:17:29,190 --> 00:17:25,600

and then the relation needs those things

488

00:17:31,909 --> 00:17:29,200

so help someone as confused as myself

489

00:17:33,750 --> 00:17:31,919

understand what is meant by relations

490

00:17:35,590 --> 00:17:33,760

are more fundamental than the things how

491

00:17:38,070 --> 00:17:35,600

is it not presupposing

492

00:17:39,669 --> 00:17:38,080

things per se

493

00:17:41,590 --> 00:17:39,679

yeah well it depends what we mean by

494

00:17:43,640 --> 00:17:41,600

thing uh that's uh that's the subtlety

495

00:17:44,830 --> 00:17:43,650

namely um if

496

00:17:46,950 --> 00:17:44,840

[Music]

497

00:17:48,789 --> 00:17:46,960

uh we we're talking about quantum

498

00:17:51,270 --> 00:17:48,799

mechanics so you're not talking about

499

00:17:53,270 --> 00:17:51,280

general philosophical view of what so i

500

00:17:54,549 --> 00:17:53,280

i'm i'm just saying what this

501
00:17:56,470 --> 00:17:54,559
interpretation quantum mechanics

502
00:17:57,430 --> 00:17:56,480
requires us to do

503
00:17:59,669 --> 00:17:57,440
all right

504
00:18:01,270 --> 00:17:59,679
so in this individual quantum mechanics

505
00:18:02,070 --> 00:18:01,280
the basic notions

506
00:18:02,870 --> 00:18:02,080
are

507
00:18:04,710 --> 00:18:02,880
a

508
00:18:07,909 --> 00:18:04,720
system

509
00:18:09,110 --> 00:18:07,919
okay so i'm not

510
00:18:10,390 --> 00:18:09,120
denying

511
00:18:12,070 --> 00:18:10,400
it it's not an interpretation that

512
00:18:14,549 --> 00:18:12,080
denies that we describe the world in

513
00:18:16,950 --> 00:18:14,559

terms of systems okay if you want to

514

00:18:18,870 --> 00:18:16,960

call a system a thing that's fine those

515

00:18:20,390 --> 00:18:18,880

are things okay

516

00:18:23,190 --> 00:18:20,400

this is a system

517

00:18:25,430 --> 00:18:23,200

a pencil okay

518

00:18:27,190 --> 00:18:25,440

and then the relation of between systems

519

00:18:28,549 --> 00:18:27,200

the things that happen between systems

520

00:18:32,230 --> 00:18:28,559

in which a

521

00:18:35,029 --> 00:18:32,240

pension has a color with respect to me

522

00:18:37,750 --> 00:18:35,039

now why is a relation

523

00:18:40,070 --> 00:18:37,760

because this this

524

00:18:42,070 --> 00:18:40,080

this pen is is yellow

525

00:18:43,669 --> 00:18:42,080

but what does it exactly mean that is

526

00:18:46,150 --> 00:18:43,679

yellow yellow is not a property of the

527

00:18:47,750 --> 00:18:46,160

pen by itself it's a property of the of

528

00:18:49,350 --> 00:18:47,760

the pen that depends on the light that

529

00:18:53,830 --> 00:18:49,360

bounces it the interaction with the

530

00:18:56,630 --> 00:18:53,840

light and the the the peculiar uh uh

531

00:18:59,270 --> 00:18:56,640

uh detectors in my eyes

532

00:19:00,870 --> 00:18:59,280

uh which do not distinguish many

533

00:19:03,750 --> 00:19:00,880

frequencies but do distinguish some

534

00:19:05,430 --> 00:19:03,760

frequency and so in terms of this

535

00:19:07,430 --> 00:19:05,440

space of colors which is not outside in

536

00:19:08,870 --> 00:19:07,440

the world is in my head

537

00:19:12,470 --> 00:19:08,880

i call yellow

538

00:19:14,789 --> 00:19:12,480

uh the way this pencil interacts with

539

00:19:17,430 --> 00:19:14,799

the lighting with me

540

00:19:19,750 --> 00:19:17,440

so the being yellow of the of the pencil

541

00:19:21,590 --> 00:19:19,760

it's really something we only understand

542

00:19:23,110 --> 00:19:21,600

if we bring into the picture also the

543

00:19:24,630 --> 00:19:23,120

light and me and my brain and the

544

00:19:26,789 --> 00:19:24,640

specific

545

00:19:29,750 --> 00:19:26,799

three kind of detectors of light in my

546

00:19:31,990 --> 00:19:29,760

eyes and so on so forth good so this

547

00:19:35,750 --> 00:19:32,000

this is an example of a relation to be

548

00:19:37,350 --> 00:19:35,760

yellow is it's a relation sense

549

00:19:39,830 --> 00:19:37,360

now

550

00:19:42,390 --> 00:19:39,840

uh why i said well depend what you mean

551
00:19:44,710 --> 00:19:42,400
by a thing because if by a thing you

552
00:19:45,990 --> 00:19:44,720
mean a an entity with a set of

553
00:19:48,630 --> 00:19:46,000
properties

554
00:19:51,669 --> 00:19:48,640
okay this is a pen is here has zero

555
00:19:53,510 --> 00:19:51,679
velocities oriented up and down with

556
00:19:57,350 --> 00:19:53,520
with a point down

557
00:20:00,310 --> 00:19:57,360
uh uh it's a certain thickness and uh a

558
00:20:01,909 --> 00:20:00,320
certain mass a certain weight and uh um

559
00:20:04,310 --> 00:20:01,919
and a certain position so on and so

560
00:20:10,549 --> 00:20:07,029
if by thing you mean this system with a

561
00:20:13,029 --> 00:20:10,559
given set of properties that it has

562
00:20:14,630 --> 00:20:13,039
then in relation quantum mechanics that

563
00:20:16,310 --> 00:20:14,640

is wrong

564

00:20:17,669 --> 00:20:16,320

because all these properties do not

565

00:20:19,990 --> 00:20:17,679

belong to the

566

00:20:22,710 --> 00:20:20,000

to the pen it belongs to the interaction

567

00:20:24,630 --> 00:20:22,720

depending on whatever it's outside

568

00:20:26,710 --> 00:20:24,640

so in relation quantum mechanics they're

569

00:20:29,669 --> 00:20:26,720

systems and and uh

570

00:20:31,909 --> 00:20:29,679

and and and relation to a system

571

00:20:33,350 --> 00:20:31,919

the properties of a system are all the

572

00:20:35,190 --> 00:20:33,360

relations

573

00:20:37,990 --> 00:20:35,200

but what we when we describe the world

574

00:20:39,750 --> 00:20:38,000

we're talking about the properties

575

00:20:41,830 --> 00:20:39,760

not talking about the systems

576

00:20:44,230 --> 00:20:41,840

we are saying well the moon is there a

577

00:20:47,190 --> 00:20:44,240

position the position is relational with

578

00:20:50,149 --> 00:20:47,200

respect to something else

579

00:20:51,830 --> 00:20:50,159

all properties are relation in in

580

00:20:56,149 --> 00:20:51,840

in quantum mechanics

581

00:21:00,230 --> 00:20:56,159

so it's not that uh the only relations

582

00:21:03,110 --> 00:21:00,240

in relation quantum mechanics is that uh

583

00:21:04,470 --> 00:21:03,120

systems have no properties unless

584

00:21:05,990 --> 00:21:04,480

uh relation

585

00:21:08,310 --> 00:21:06,000

except relational properties are not

586

00:21:11,430 --> 00:21:08,320

properties by themselves

587

00:21:14,149 --> 00:21:11,440

having said yes one is tempted

588

00:21:17,190 --> 00:21:14,159

uh and and many philosophers want to do

589

00:21:19,669 --> 00:21:17,200

that and i have some sympathy for them

590

00:21:21,990 --> 00:21:19,679

to make one step further

591

00:21:24,950 --> 00:21:22,000

uh michelle bit bald is a good example

592

00:21:26,470 --> 00:21:24,960

that his immediate reaction to a

593

00:21:28,549 --> 00:21:26,480

racial quantum mechanic said well why

594

00:21:30,630 --> 00:21:28,559

don't you take one step further

595

00:21:33,909 --> 00:21:30,640

and say well for forget the system the

596

00:21:37,029 --> 00:21:33,919

systems are just the

597

00:21:39,750 --> 00:21:37,039

uh intersections so to say

598

00:21:42,070 --> 00:21:39,760

between between relations

599

00:21:43,510 --> 00:21:42,080

and you say this is hard for you to

600

00:21:45,590 --> 00:21:43,520

conceive because it's a relation

601
00:21:47,350 --> 00:21:45,600
required to think that's true

602
00:21:48,710 --> 00:21:47,360
but uh

603
00:21:51,110 --> 00:21:48,720
you know

604
00:21:52,710 --> 00:21:51,120
think of a network a net a net of a

605
00:21:55,029 --> 00:21:52,720
fisherman

606
00:21:57,190 --> 00:21:55,039
you can say it's a set of nodes

607
00:21:58,470 --> 00:21:57,200
attached by little links

608
00:22:01,029 --> 00:21:58,480
fine

609
00:22:03,830 --> 00:22:01,039
but you can say it's just the links

610
00:22:06,149 --> 00:22:03,840
the notes come just as a peculiar point

611
00:22:12,310 --> 00:22:09,750
the links are attached to one another

612
00:22:13,909 --> 00:22:12,320
so uh it's the same with a graph more

613
00:22:15,750 --> 00:22:13,919

abstractly you can think of you can

614

00:22:17,510 --> 00:22:15,760

define a graph in two ways you can say

615

00:22:18,390 --> 00:22:17,520

it's a set of points

616

00:22:20,070 --> 00:22:18,400

and then

617

00:22:21,830 --> 00:22:20,080

relation between the point i mean there

618

00:22:24,230 --> 00:22:21,840

is a there is a link between two points

619

00:22:27,669 --> 00:22:24,240

that simulation or not

620

00:22:31,190 --> 00:22:27,679

or you can say it's a set of links

621

00:22:33,830 --> 00:22:31,200

and then you say who's who is

622

00:22:34,870 --> 00:22:33,840

which one of the link joined to the

623

00:22:36,470 --> 00:22:34,880

other

624

00:22:38,630 --> 00:22:36,480

so you can start from the point of start

625

00:22:41,830 --> 00:22:38,640

from the links to to think of a graph

626
00:22:43,350 --> 00:22:41,840
and so in that sense you might want to

627
00:22:46,470 --> 00:22:43,360
uh just

628
00:22:49,029 --> 00:22:46,480
view the systems as just nodes

629
00:22:51,110 --> 00:22:49,039
of networks after all

630
00:22:52,630 --> 00:22:51,120
uh we never see the moon we see its

631
00:22:55,669 --> 00:22:52,640
properties

632
00:22:58,710 --> 00:22:55,679
so our direct contact with the world is

633
00:23:01,430 --> 00:22:58,720
through uh the properties of this object

634
00:23:03,510 --> 00:23:01,440
from which we construct the object

635
00:23:06,310 --> 00:23:03,520
some philosophy might want to go

636
00:23:07,430 --> 00:23:06,320
all that way uh i have some sympathy but

637
00:23:09,270 --> 00:23:07,440
i don't think that the malaysia

638
00:23:11,350 --> 00:23:09,280

interpretation quantum mechanics uh

639

00:23:13,669 --> 00:23:11,360

requires that relation with the quantum

640

00:23:15,590 --> 00:23:13,679

mechanics in terms of systems

641

00:23:16,950 --> 00:23:15,600

and uh relational properties between the

642

00:23:19,270 --> 00:23:16,960

systems

643

00:23:21,830 --> 00:23:19,280

no okay so you said that we can describe

644

00:23:23,909 --> 00:23:21,840

a system or a system of that's a graph

645

00:23:25,909 --> 00:23:23,919

let's say in terms of treating the edges

646

00:23:28,149 --> 00:23:25,919

as primary or the vertices is primary

647

00:23:30,710 --> 00:23:28,159

and then you can infer correct okay so

648

00:23:32,230 --> 00:23:30,720

exactly is there a reason that

649

00:23:33,430 --> 00:23:32,240

it seems like

650

00:23:35,350 --> 00:23:33,440

because they're interchangeable you

651
00:23:36,789 --> 00:23:35,360
could place emphasis on anyone why is it

652
00:23:38,390 --> 00:23:36,799
that you're

653
00:23:40,549 --> 00:23:38,400
choosing or why is it that it's better

654
00:23:43,830 --> 00:23:40,559
to place emphasis on the relations

655
00:23:46,789 --> 00:23:43,840
rather than the notes the edges right

656
00:23:49,110 --> 00:23:46,799
i think we can do both

657
00:23:52,470 --> 00:23:49,120
i think i think both are doable as far

658
00:23:57,430 --> 00:23:52,480
as quantum mechanics is uh

659
00:24:17,669 --> 00:23:59,269
i

660
00:24:19,830 --> 00:24:17,679
non-property laden node

661
00:24:21,669 --> 00:24:19,840
because as soon as i can visualize i

662
00:24:23,750 --> 00:24:21,679
feel like i've assigned a property to it

663
00:24:26,390 --> 00:24:23,760

so what is meant by this

664

00:24:28,630 --> 00:24:26,400

what is meant by what's being related

665

00:24:32,070 --> 00:24:28,640

is it and is it physical what is meant

666

00:24:35,110 --> 00:24:32,080

by physicality like what the heck is it

667

00:24:37,350 --> 00:24:35,120

now also by the way you can answer as if

668

00:24:38,950 --> 00:24:37,360

it's the spin network like you i don't

669

00:24:40,070 --> 00:24:38,960

know is it that is that what you're

670

00:24:42,310 --> 00:24:40,080

ultimately claiming or is it something

671

00:24:44,630 --> 00:24:42,320

even more fundamental you're unsure of

672

00:24:47,430 --> 00:24:44,640

mathematically how it looks like

673

00:24:48,390 --> 00:24:47,440

take this question any way you like

674

00:24:49,350 --> 00:24:48,400

uh

675

00:24:51,510 --> 00:24:49,360

well

676
00:24:52,950 --> 00:24:51,520
thanks for bringing up the spin networks

677
00:24:55,269 --> 00:24:52,960
um

678
00:24:57,190 --> 00:24:55,279
no i think one

679
00:24:58,870 --> 00:24:57,200
one thing is interpretation of quantum

680
00:25:00,390 --> 00:24:58,880
mechanics

681
00:25:01,669 --> 00:25:00,400
and and the difference the spin net will

682
00:25:03,669 --> 00:25:01,679
come from a different story which is

683
00:25:05,510 --> 00:25:03,679
quantum gravity

684
00:25:07,190 --> 00:25:05,520
uh now

685
00:25:08,630 --> 00:25:07,200
uh let's say on the interpretation

686
00:25:10,630 --> 00:25:08,640
quantum mechanics which is what you're

687
00:25:13,510 --> 00:25:10,640
asking about uh

688
00:25:15,830 --> 00:25:13,520

is one important point quantum mechanics

689

00:25:17,510 --> 00:25:15,840

is not a theory about the world it's a

690

00:25:18,870 --> 00:25:17,520

collection of theories about the world

691

00:25:20,549 --> 00:25:18,880

there is a quantum mechanics of a

692

00:25:22,230 --> 00:25:20,559

particle it's a quantum mechanic of the

693

00:25:23,990 --> 00:25:22,240

standard model there's a quantum

694

00:25:26,230 --> 00:25:24,000

mechanic of gravity which is quantum

695

00:25:28,070 --> 00:25:26,240

gravity uh you know there's a quantum

696

00:25:29,350 --> 00:25:28,080

mechanic of harmonic oscillator there's

697

00:25:31,269 --> 00:25:29,360

a quantum mechanic for the molecule

698

00:25:32,310 --> 00:25:31,279

there's a quantum mechanics of the early

699

00:25:35,590 --> 00:25:32,320

universe

700

00:25:37,669 --> 00:25:35,600

quantum mechanics of the of the of the

701

00:25:41,029 --> 00:25:37,679

what happens inside the sun

702

00:25:44,149 --> 00:25:41,039

so uh quantum mechanics is not a list

703

00:25:46,950 --> 00:25:44,159

of of things out there in the world

704

00:25:48,549 --> 00:25:46,960

uh to have a list of things out there in

705

00:25:51,350 --> 00:25:48,559

the world you should

706

00:25:53,830 --> 00:25:51,360

choose a particular quantum theory

707

00:25:55,990 --> 00:25:53,840

okay not quantitative in general but one

708

00:25:57,830 --> 00:25:56,000

particular platform so quantum mechanics

709

00:25:59,750 --> 00:25:57,840

says okay what is it quantum mechanics

710

00:26:01,350 --> 00:25:59,760

quantum mechanics says that any theory

711

00:26:03,350 --> 00:26:01,360

of the world okay

712

00:26:05,190 --> 00:26:03,360

can be formulated in this way there's a

713

00:26:07,190 --> 00:26:05,200

non-community variable maybe there's a

714

00:26:11,190 --> 00:26:07,200

hilbert space there's some mathematics

715

00:26:12,950 --> 00:26:11,200

of the structure of the mathematics

716

00:26:15,269 --> 00:26:12,960

then you have to say

717

00:26:16,870 --> 00:26:15,279

which variables which

718

00:26:17,909 --> 00:26:16,880

hamiltonian

719

00:26:22,390 --> 00:26:17,919

which

720

00:26:23,750 --> 00:26:22,400

things you describe in that sense um

721

00:26:26,789 --> 00:26:23,760

quantum mechanics is like classical

722

00:26:28,710 --> 00:26:26,799

mechanics classical mechanics is not

723

00:26:31,830 --> 00:26:28,720

a theory of particles

724

00:26:33,990 --> 00:26:31,840

it's theory of anything of a pendulum of

725

00:26:35,590 --> 00:26:34,000

particles of the electric field of

726

00:26:38,149 --> 00:26:35,600

whatever it's just

727

00:26:39,430 --> 00:26:38,159

then it's just a general framework

728

00:26:41,510 --> 00:26:39,440

within which

729

00:26:43,269 --> 00:26:41,520

then you have to specify your variables

730

00:26:44,070 --> 00:26:43,279

face space lagrangian liquidity or

731

00:26:45,190 --> 00:26:44,080

motion

732

00:26:46,070 --> 00:26:45,200

whatever

733

00:26:47,350 --> 00:26:46,080

all right

734

00:26:48,789 --> 00:26:47,360

so uh

735

00:26:51,110 --> 00:26:48,799

if you want to know

736

00:26:52,470 --> 00:26:51,120

how do we currently describe the world

737

00:26:54,710 --> 00:26:52,480

you shouldn't ask what does quantum

738

00:26:56,789 --> 00:26:54,720

mechanics say you should ask what is in

739

00:26:59,430 --> 00:26:56,799

the standard model what is the general

740

00:27:01,510 --> 00:26:59,440

relativity what are the ingredients

741

00:27:02,870 --> 00:27:01,520

of the worlds of the world

742

00:27:05,029 --> 00:27:02,880

so if i do

743

00:27:07,909 --> 00:27:05,039

let's take the simplest case if i do the

744

00:27:09,990 --> 00:27:07,919

quantum mechanics of a particle

745

00:27:11,990 --> 00:27:10,000

okay it's a schrodinger equation of a

746

00:27:13,110 --> 00:27:12,000

single particle

747

00:27:15,029 --> 00:27:13,120

uh

748

00:27:17,110 --> 00:27:15,039

how do i think the system

749

00:27:19,029 --> 00:27:17,120

well it's a particle

750

00:27:21,669 --> 00:27:19,039

it's just this particle and how do i

751

00:27:23,590 --> 00:27:21,679

visualize the system exactly the the

752

00:27:25,669 --> 00:27:23,600

classical way i visualize a particle

753

00:27:27,350 --> 00:27:25,679

there's a particle moving there and if i

754

00:27:30,230 --> 00:27:27,360

do an electromagnetic field i think the

755

00:27:31,830 --> 00:27:30,240

electromagnetic field or many photons

756

00:27:33,269 --> 00:27:31,840

and if i do the standard model i think

757

00:27:35,350 --> 00:27:33,279

all the complexity of the field for the

758

00:27:37,510 --> 00:27:35,360

standard model of the particles animal

759

00:27:38,950 --> 00:27:37,520

now the point is

760

00:27:40,389 --> 00:27:38,960

that let's say on the part of the

761

00:27:44,310 --> 00:27:40,399

particle

762

00:27:46,789 --> 00:27:44,320

okay but

763

00:27:49,590 --> 00:27:46,799

i have to remember that this

764

00:27:52,549 --> 00:27:49,600

entity this system the particle

765

00:27:54,230 --> 00:27:52,559

has a position here

766

00:27:57,669 --> 00:27:54,240

with respect to me in the moment is

767

00:28:00,230 --> 00:27:57,679

interacting with me i should not think

768

00:28:02,230 --> 00:28:00,240

that it always have a position

769

00:28:04,470 --> 00:28:02,240

the position is the way the particle

770

00:28:06,149 --> 00:28:04,480

interacts with me

771

00:28:08,789 --> 00:28:06,159

so if i interact with a particle and

772

00:28:10,389 --> 00:28:08,799

there's a wall with two two holes and i

773

00:28:12,710 --> 00:28:10,399

interact again with a particle the other

774

00:28:15,510 --> 00:28:12,720

side of the wall i should not think that

775

00:28:17,590 --> 00:28:15,520

the particle always had a position

776

00:28:19,190 --> 00:28:17,600

and therefore had to choose one hole or

777

00:28:20,710 --> 00:28:19,200

the other

778

00:28:23,350 --> 00:28:20,720

particle might pass through the two

779

00:28:25,990 --> 00:28:23,360

holes because it doesn't have a position

780

00:28:28,470 --> 00:28:26,000

while it's not interacting with me

781

00:28:29,909 --> 00:28:28,480

and when is interacting with me it has a

782

00:28:31,830 --> 00:28:29,919

position so that's it that's the

783

00:28:33,909 --> 00:28:31,840

particle that i see but in that

784

00:28:36,789 --> 00:28:33,919

particular moment not necessarily with

785

00:28:38,950 --> 00:28:36,799

respect to u has a position because with

786

00:28:41,510 --> 00:28:38,960

respect to u it's possible that b and

787

00:28:44,149 --> 00:28:41,520

the particle neither have a position

788

00:28:45,909 --> 00:28:44,159

okay in your description we're both in a

789

00:28:47,990 --> 00:28:45,919

quantum superposition of different

790

00:28:49,350 --> 00:28:48,000

branches of universe whatever

791

00:28:51,190 --> 00:28:49,360

okay so we're not supposed to think in

792

00:28:52,870 --> 00:28:51,200

terms of is or at least it's not useful

793

00:28:54,230 --> 00:28:52,880

i think in terms of relations but also

794

00:28:55,990 --> 00:28:54,240

at the same time i remember in your book

795

00:28:57,510 --> 00:28:56,000

you said nature is what it is

796

00:28:59,909 --> 00:28:57,520

so how am i supposed to make it it is

797

00:29:01,350 --> 00:28:59,919

nature is what it is but then let's not

798

00:29:02,549 --> 00:29:01,360

think in terms of is

799

00:29:04,710 --> 00:29:02,559

am i just taking that a bit too

800

00:29:06,630 --> 00:29:04,720

literally

801
00:29:09,190 --> 00:29:06,640
well it is

802
00:29:13,909 --> 00:29:09,200
do i say nature is what it is nature is

803
00:29:20,950 --> 00:29:14,870
i

804
00:29:22,070 --> 00:29:20,960
of

805
00:29:26,470 --> 00:29:22,080
confusing

806
00:29:30,149 --> 00:29:27,990
um

807
00:29:32,870 --> 00:29:30,159
let me make a simple example in special

808
00:29:34,549 --> 00:29:32,880
relativity or in galileo relativity

809
00:29:36,310 --> 00:29:34,559
we always say the position the velocity

810
00:29:37,269 --> 00:29:36,320
with respect to one observer

811
00:29:38,710 --> 00:29:37,279
okay

812
00:29:41,590 --> 00:29:38,720
um

813
00:29:43,669 --> 00:29:41,600

if i am on the train the velocity of

814

00:29:45,830 --> 00:29:43,679

something somebody sitting next to me is

815

00:29:47,269 --> 00:29:45,840

zero with respect to the observer me but

816

00:29:49,990 --> 00:29:47,279

if you're outside the train the velocity

817

00:29:52,230 --> 00:29:50,000

with respect to you to another observer

818

00:29:53,909 --> 00:29:52,240

is different now we use observer there

819

00:29:55,510 --> 00:29:53,919

but of course this is nothing to do with

820

00:29:56,710 --> 00:29:55,520

the fact that we're human beings we're

821

00:29:58,470 --> 00:29:56,720

thinking right you could say the

822

00:30:00,710 --> 00:29:58,480

velocity of respect to a lump

823

00:30:02,870 --> 00:30:00,720

or there was a respect to a table okay

824

00:30:04,789 --> 00:30:02,880

so a table can be an observer from this

825

00:30:06,950 --> 00:30:04,799

perspective so what we're only saying

826

00:30:08,470 --> 00:30:06,960

that velocity is a relative constant

827

00:30:10,389 --> 00:30:08,480

it's a relational concept it's not a

828

00:30:12,549 --> 00:30:10,399

property of an object it's a property of

829

00:30:13,830 --> 00:30:12,559

two objects there's no velocity of one

830

00:30:16,870 --> 00:30:13,840

object there's only velocity of one

831

00:30:21,830 --> 00:30:19,269

so um

832

00:30:24,549 --> 00:30:21,840

in quantum

833

00:30:26,310 --> 00:30:24,559

i think is similar the the

834

00:30:28,149 --> 00:30:26,320

the properties are relational not with

835

00:30:29,350 --> 00:30:28,159

respect to an observer not respect to

836

00:30:35,110 --> 00:30:29,360

mind

837

00:30:36,470 --> 00:30:35,120

talk about bernardo castro up soon

838

00:30:38,230 --> 00:30:36,480

so don't worry we'll get the mind we

839

00:30:39,350 --> 00:30:38,240

don't we don't want to go to that or we

840

00:30:41,510 --> 00:30:39,360

can get there

841

00:30:42,950 --> 00:30:41,520

there but i i don't think at all that

842

00:30:45,269 --> 00:30:42,960

quantum mechanics take us in that

843

00:30:46,630 --> 00:30:45,279

direction uh it tell us that things are

844

00:30:48,950 --> 00:30:46,640

relational

845

00:30:52,230 --> 00:30:48,960

not the things are relative to mind

846

00:30:55,909 --> 00:30:53,669

why this is relevant

847

00:30:56,870 --> 00:30:55,919

to your question because

848

00:31:07,190 --> 00:30:56,880

i

849

00:31:08,950 --> 00:31:07,200

we do a lot of stuff that tables and

850

00:31:11,110 --> 00:31:08,960

chairs don't do

851
00:31:12,149 --> 00:31:11,120
but as far as physical properties are

852
00:31:15,029 --> 00:31:12,159
concerned

853
00:31:17,909 --> 00:31:15,039
we're just physical things so

854
00:31:19,509 --> 00:31:17,919
we want to know how nature works in

855
00:31:21,509 --> 00:31:19,519
general on the basis of our experience

856
00:31:23,590 --> 00:31:21,519
of also a limited experience that's the

857
00:31:26,070 --> 00:31:23,600
picture we have about nature and we want

858
00:31:27,669 --> 00:31:26,080
to know how how how work

859
00:31:29,830 --> 00:31:27,679
how digital works with with its

860
00:31:32,070 --> 00:31:29,840
interactions with this

861
00:31:35,029 --> 00:31:32,080
relative variables and that's in the

862
00:31:36,870 --> 00:31:35,039
sense that that's that that's a universe

863
00:31:38,230 --> 00:31:36,880

with its

864

00:31:40,950 --> 00:31:38,240

uh

865

00:31:43,509 --> 00:31:40,960

relational aspects

866

00:31:45,029 --> 00:31:43,519

so for velocity we got used to it

867

00:31:47,909 --> 00:31:45,039

nothing has a velocity by itself

868

00:31:49,830 --> 00:31:47,919

velocity is just a relational thing

869

00:31:52,710 --> 00:31:49,840

since i'm an object i see velocity with

870

00:31:54,230 --> 00:31:52,720

respect to me fine i see that something

871

00:31:56,389 --> 00:31:54,240

is not moving respect to me something

872

00:31:58,549 --> 00:31:56,399

else is but i don't

873

00:32:01,590 --> 00:31:58,559

recognize this as a special point of

874

00:32:04,389 --> 00:32:03,110

with respect to

875

00:32:06,470 --> 00:32:04,399

to jupiter

876
00:32:07,590 --> 00:32:06,480
velocity of everything is different

877
00:32:08,389 --> 00:32:07,600
okay

878
00:32:11,269 --> 00:32:08,399
so

879
00:32:13,269 --> 00:32:11,279
it's a story about nature as it is not

880
00:32:14,870 --> 00:32:13,279
about our own

881
00:32:17,110 --> 00:32:14,880
picture of nature

882
00:32:19,190 --> 00:32:17,120
and as always you know

883
00:32:21,430 --> 00:32:19,200
we learn that we're not special we make

884
00:32:22,789 --> 00:32:21,440
a larger picture of reality

885
00:32:28,549 --> 00:32:22,799
we

886
00:32:30,549 --> 00:32:28,559
um and that's nature out there

887
00:32:33,029 --> 00:32:30,559
okay let me see if i can summarize so

888
00:32:35,029 --> 00:32:33,039

like you said we take a pen or a cup and

889

00:32:37,029 --> 00:32:35,039

ordinarily we can assign its position

890

00:32:39,029 --> 00:32:37,039

and it's momentum and you're saying well

891

00:32:41,509 --> 00:32:39,039

obviously momentum is relative even

892

00:32:43,509 --> 00:32:41,519

position is relative because that's more

893

00:32:45,029 --> 00:32:43,519

immediate it's two meters away from me

894

00:32:46,870 --> 00:32:45,039

but it's not it's probably thousands of

895

00:32:47,990 --> 00:32:46,880

meters away from you tens of thousands

896

00:32:49,909 --> 00:32:48,000

and so on

897

00:32:51,590 --> 00:32:49,919

okay now what if there are other aspects

898

00:32:53,190 --> 00:32:51,600

of this cup that we think are inherent

899

00:32:54,549 --> 00:32:53,200

in the cup so mass

900

00:32:56,470 --> 00:32:54,559

the amount of liquid in it the

901
00:32:58,789 --> 00:32:56,480
reflective properties and so on what if

902
00:33:00,870 --> 00:32:58,799
those are also relational and for any

903
00:33:02,630 --> 00:33:00,880
conceivable property it's not saying

904
00:33:04,789 --> 00:33:02,640
there is nothing there is no thing

905
00:33:06,310 --> 00:33:04,799
behind the cup it's saying that

906
00:33:08,870 --> 00:33:06,320
whatever we think of as this thing

907
00:33:10,549 --> 00:33:08,880
behind the cup is not what we

908
00:33:12,389 --> 00:33:10,559
i don't know if we can even have a model

909
00:33:13,350 --> 00:33:12,399
of it because our models are so property

910
00:33:15,430 --> 00:33:13,360
laden

911
00:33:17,190 --> 00:33:15,440
but whatever it is it's not what we

912
00:33:18,950 --> 00:33:17,200
precisely think you have a book reality

913
00:33:22,149 --> 00:33:18,960

is not what it seems so reality of this

914

00:33:24,470 --> 00:33:22,159

cup is not what it seems is that correct

915

00:33:26,149 --> 00:33:24,480

yeah it's correct it's exactly so

916

00:33:27,509 --> 00:33:26,159

and exactly in fact one way of seeing is

917

00:33:31,110 --> 00:33:27,519

that uh

918

00:33:35,350 --> 00:33:32,470

understanding quantum mechanics

919

00:33:38,950 --> 00:33:36,870

we always knew that there are many

920

00:33:41,029 --> 00:33:38,960

relational properties out there right

921

00:33:41,830 --> 00:33:41,039

velocity relational

922

00:33:47,110 --> 00:33:41,840

um

923

00:33:48,470 --> 00:33:47,120

tell us that all properties are relation

924

00:33:51,110 --> 00:33:48,480

you know firstly

925

00:33:53,350 --> 00:33:51,120

i find you to be extremely philosophical

926
00:33:55,509 --> 00:33:53,360
and much more so than

927
00:33:57,029 --> 00:33:55,519
much more so than the average much much

928
00:33:59,669 --> 00:33:57,039
more so than the average physics

929
00:34:00,470 --> 00:33:59,679
professor i'm curious do you see that

930
00:34:05,590 --> 00:34:00,480
and

931
00:34:08,389 --> 00:34:05,600
true do you feel that's true

932
00:34:10,310 --> 00:34:08,399
uh i'm happy you asked this question and

933
00:34:12,230 --> 00:34:10,320
uh let me answer

934
00:34:14,869 --> 00:34:12,240
in this way depend on what you mean the

935
00:34:16,710 --> 00:34:14,879
average uh physical professor if you

936
00:34:18,950 --> 00:34:16,720
mean

937
00:34:20,389 --> 00:34:18,960
today's physical professors the answer

938
00:34:21,750 --> 00:34:20,399

is definitely yes

939

00:34:23,990 --> 00:34:21,760

i'm not unique

940

00:34:26,310 --> 00:34:24,000

there are many other like me i mean i

941

00:34:27,750 --> 00:34:26,320

could name many that are

942

00:34:29,510 --> 00:34:27,760

us philosophically or even more

943

00:34:33,030 --> 00:34:29,520

philosophically but the

944

00:34:34,389 --> 00:34:33,040

very very large majority of contemporary

945

00:34:36,149 --> 00:34:34,399

um

946

00:34:38,869 --> 00:34:36,159

physics professors are far less

947

00:34:41,109 --> 00:34:38,879

philosophical however

948

00:34:42,389 --> 00:34:41,119

if you look at the past

949

00:34:45,109 --> 00:34:42,399

um

950

00:34:47,349 --> 00:34:45,119

look uh i don't know 100 years ago in

951
00:34:50,470 --> 00:34:47,359
the in the 20s or

952
00:34:51,349 --> 00:34:50,480
of of the of the twentieth century

953
00:34:52,790 --> 00:34:51,359
um

954
00:34:54,869 --> 00:34:52,800
and if you look just look at the great

955
00:34:57,190 --> 00:34:54,879
scientists at the time uh

956
00:35:00,790 --> 00:34:57,200
schroedinger heisenberg

957
00:35:02,790 --> 00:35:00,800
einstein bore the bulgy they were far

958
00:35:05,349 --> 00:35:02,800
more philosophical than me

959
00:35:07,990 --> 00:35:05,359
they were inspired by philosophy reading

960
00:35:10,150 --> 00:35:08,000
philosophy talking philosophy discussing

961
00:35:12,150 --> 00:35:10,160
philosophy

962
00:35:14,390 --> 00:35:12,160
and that includes newton includes

963
00:35:15,589 --> 00:35:14,400

boltzmann includes maxwell includes

964

00:35:18,150 --> 00:35:15,599

faraday

965

00:35:19,750 --> 00:35:18,160

so um

966

00:35:23,109 --> 00:35:19,760

i think that the

967

00:35:25,109 --> 00:35:23,119

major advances in science in physics

968

00:35:26,150 --> 00:35:25,119

in the past but also i mean in other

969

00:35:28,230 --> 00:35:26,160

sciences

970

00:35:29,270 --> 00:35:28,240

in biology darvin was enormously

971

00:35:30,710 --> 00:35:29,280

philosophical he was a reading

972

00:35:32,310 --> 00:35:30,720

philosopher it was strongly influenced

973

00:35:33,829 --> 00:35:32,320

by philosophers

974

00:35:35,910 --> 00:35:33,839

um

975

00:35:37,750 --> 00:35:35,920

so i think that uh

976
00:35:39,030 --> 00:35:37,760
especially in foundational questions of

977
00:35:42,630 --> 00:35:39,040
course if you

978
00:35:44,390 --> 00:35:42,640
the more you go to to apply to specific

979
00:35:45,750 --> 00:35:44,400
systems you're less

980
00:35:47,990 --> 00:35:45,760
you need i mean

981
00:35:49,030 --> 00:35:48,000
you do need a philosophical mind also

982
00:35:51,990 --> 00:35:49,040
for some

983
00:35:53,750 --> 00:35:52,000
some questions in in more more less

984
00:35:55,270 --> 00:35:53,760
foundational questions but but when

985
00:35:56,230 --> 00:35:55,280
you're close to foundational questions

986
00:35:58,950 --> 00:35:56,240
uh

987
00:36:02,470 --> 00:35:58,960
science in the past in the past i mean

988
00:36:04,310 --> 00:36:02,480

until the 60s no

989

00:36:07,589 --> 00:36:04,320

the past

990

00:36:10,870 --> 00:36:07,599

has been very close to uh

991

00:36:13,190 --> 00:36:10,880

to philosophy philosophy questions

992

00:36:15,430 --> 00:36:13,200

influenced by uh by philosophy and and

993

00:36:16,390 --> 00:36:15,440

talking philosophical terms

994

00:36:19,670 --> 00:36:16,400

um

995

00:36:22,069 --> 00:36:19,680

i mean just read einstein einstein

996

00:36:24,230 --> 00:36:22,079

einstein who is a champion of

997

00:36:25,349 --> 00:36:24,240

theoretical physicist for everybody i

998

00:36:26,870 --> 00:36:25,359

would say

999

00:36:29,670 --> 00:36:26,880

uh he

1000

00:36:32,069 --> 00:36:29,680

he has read the three main books by kant

1001

00:36:34,870 --> 00:36:32,079

before getting being 16.

1002

00:36:36,390 --> 00:36:34,880

he was very he read the hume he read the

1003

00:36:40,390 --> 00:36:36,400

uh chopin hour

1004

00:36:42,630 --> 00:36:40,400

uh the philosophical writing of poncare

1005

00:36:43,589 --> 00:36:42,640

as a philosopher

1006

00:36:45,990 --> 00:36:43,599

and

1007

00:36:48,390 --> 00:36:46,000

it's obvious once you go into what he

1008

00:36:50,950 --> 00:36:48,400

did that everything he did

1009

00:36:53,109 --> 00:36:50,960

was very much affected by this

1010

00:36:56,390 --> 00:36:53,119

philosophical thinking

1011

00:36:57,750 --> 00:36:56,400

so i think uh you're right i am

1012

00:36:59,510 --> 00:36:57,760

more

1013

00:37:02,550 --> 00:36:59,520

i belong to the to those scientists who

1014

00:37:06,829 --> 00:37:02,560

are more philosophical than many others

1015

00:37:15,270 --> 00:37:08,390

a

1016

00:37:19,670 --> 00:37:15,280

uh to be

1017

00:37:23,990 --> 00:37:19,680

very technical very mathematical very

1018

00:37:29,030 --> 00:37:25,589

yeah or

1019

00:37:30,710 --> 00:37:29,040

or just do mathematical modeling i think

1020

00:37:33,270 --> 00:37:30,720

that if you invent a sufficiently

1021

00:37:35,190 --> 00:37:33,280

complicated mathematics

1022

00:37:37,430 --> 00:37:35,200

uh you bring this and this and this and

1023

00:37:39,349 --> 00:37:37,440

this and this very hard mathematics and

1024

00:37:41,270 --> 00:37:39,359

blah blah blah and that's you're getting

1025

00:37:43,750 --> 00:37:41,280

close to reality

1026

00:37:45,190 --> 00:37:43,760

maybe not

1027

00:37:46,950 --> 00:37:45,200

you know some people say don't mistake

1028

00:37:52,150 --> 00:37:46,960

the map for the territory

1029

00:37:56,069 --> 00:37:54,710

because i think that a lot of uh

1030

00:37:57,829 --> 00:37:56,079

current

1031

00:37:59,990 --> 00:37:57,839

working theoretical physics is a map

1032

00:38:03,829 --> 00:38:00,000

without a territory

1033

00:38:05,910 --> 00:38:03,839

right now max take mark and i haven't

1034

00:38:07,109 --> 00:38:05,920

seen his lectures on this but i'm sure

1035

00:38:08,630 --> 00:38:07,119

he would object because he has the

1036

00:38:10,390 --> 00:38:08,640

mathematical universe as his

1037

00:38:11,349 --> 00:38:10,400

philosophical framework

1038

00:38:14,470 --> 00:38:11,359

oh

1039

00:38:16,630 --> 00:38:14,480

not at all i mean i think max stegmark

1040

00:38:17,990 --> 00:38:16,640

who is a thinker i deeply respect is one

1041

00:38:19,589 --> 00:38:18,000

of the most philosophical even more

1042

00:38:21,670 --> 00:38:19,599

philosophical than me

1043

00:38:23,829 --> 00:38:21,680

i mean he's a

1044

00:38:25,589 --> 00:38:23,839

he's a philosopher compared to me i mean

1045

00:38:27,349 --> 00:38:25,599

he's a guy who wrote a book claiming

1046

00:38:29,030 --> 00:38:27,359

that every

1047

00:38:31,750 --> 00:38:29,040

um

1048

00:38:33,430 --> 00:38:31,760

every possible coherent mathematically

1049

00:38:35,829 --> 00:38:33,440

described universe is

1050

00:38:38,550 --> 00:38:35,839

as real as the

1051

00:38:39,589 --> 00:38:38,560

our actual one

1052

00:38:41,589 --> 00:38:39,599

um

1053

00:38:44,390 --> 00:38:41,599

that's deep philosophy it has nothing to

1054

00:38:46,950 --> 00:38:44,400

do with direct physics in us it's right

1055

00:38:47,910 --> 00:38:46,960

it's it's wonderful speculations

1056

00:38:52,950 --> 00:38:47,920

max

1057

00:38:54,310 --> 00:38:52,960

an astrophysicist but has a

1058

00:38:56,550 --> 00:38:54,320

a a

1059

00:38:58,550 --> 00:38:56,560

range of wide uh

1060

00:39:00,630 --> 00:38:58,560

very philosophical speculations i think

1061

00:39:02,069 --> 00:39:00,640

we need more people like max

1062

00:39:03,109 --> 00:39:02,079

and less people

1063

00:39:03,990 --> 00:39:03,119

who

1064

00:39:06,470 --> 00:39:04,000

uh

1065

00:39:07,430 --> 00:39:06,480

who just do mathematics without really

1066

00:39:09,349 --> 00:39:07,440

asking

1067

00:39:11,270 --> 00:39:09,359

what is real reality i'm actually

1068

00:39:13,750 --> 00:39:11,280

describing here

1069

00:39:16,550 --> 00:39:13,760

do you see that there's not only a lack

1070

00:39:18,470 --> 00:39:16,560

of philosophical ideation but perhaps a

1071

00:39:20,550 --> 00:39:18,480

resistance to it do you see an aversion

1072

00:39:23,190 --> 00:39:20,560

to it or do you just see it as they lack

1073

00:39:24,470 --> 00:39:23,200

it there's an absence of it

1074

00:39:27,190 --> 00:39:24,480

when i say they i mean let's say the

1075

00:39:30,150 --> 00:39:27,200

average mathematician or physical or

1076

00:39:32,230 --> 00:39:30,160

both both both let's not forget that

1077

00:39:34,630 --> 00:39:32,240

stephen weinberg who is a great

1078

00:39:36,069 --> 00:39:34,640

scientist of course with major major

1079

00:39:38,230 --> 00:39:36,079

results

1080

00:39:40,829 --> 00:39:38,240

wrote a book and one of the chapter of

1081

00:39:44,630 --> 00:39:40,839

the book the title is against

1082

00:39:45,750 --> 00:39:44,640

philosophy and and uh uh stephen hawking

1083

00:39:47,990 --> 00:39:45,760

who is a

1084

00:39:50,230 --> 00:39:48,000

very good physicist of course and he did

1085

00:39:51,829 --> 00:39:50,240

he had important results not as good as

1086

00:39:53,589 --> 00:39:51,839

what weinberg but totally very very

1087

00:39:55,829 --> 00:39:53,599

important

1088

00:39:57,990 --> 00:39:55,839

it's on the record to say many times

1089

00:40:00,870 --> 00:39:58,000

philosophy is dead

1090

00:40:03,270 --> 00:40:00,880

um because now we have signs that solve

1091

00:40:04,870 --> 00:40:03,280

all the problems uh i wish it was true

1092

00:40:06,950 --> 00:40:04,880

but it's wrong because it doesn't solve

1093

00:40:08,950 --> 00:40:06,960

problems it has a lot of problems by

1094

00:40:11,349 --> 00:40:08,960

itself um

1095

00:40:13,270 --> 00:40:11,359

and and and so

1096

00:40:16,069 --> 00:40:13,280

philosophy is not dead philosophy isn't

1097

00:40:18,390 --> 00:40:16,079

constantly interacting with uh um the

1098

00:40:21,109 --> 00:40:18,400

reason is

1099

00:40:23,270 --> 00:40:21,119

that science is not about uh you know

1100

00:40:25,750 --> 00:40:23,280

you make measurement

1101

00:40:27,190 --> 00:40:25,760

and then you write it in the equation

1102

00:40:28,870 --> 00:40:27,200

and then you check your equation with

1103

00:40:30,630 --> 00:40:28,880

the measurement if it is wrong you throw

1104

00:40:33,589 --> 00:40:30,640

it away you try another one that's not

1105

00:40:36,550 --> 00:40:33,599

the way science works the science is

1106

00:40:41,430 --> 00:40:39,270

changing of the conceptual structure you

1107

00:40:43,910 --> 00:40:41,440

use for describing the world

1108

00:40:45,510 --> 00:40:43,920

you rearrange things right you call this

1109

00:40:47,589 --> 00:40:45,520

together you call this separate you

1110

00:40:49,510 --> 00:40:47,599

think differently use different notions

1111

00:40:51,670 --> 00:40:49,520

different concepts

1112

00:40:54,550 --> 00:40:51,680

uh you know copernicus instead of

1113

00:40:56,790 --> 00:40:54,560

seeking the earth the sky you know

1114

00:40:59,829 --> 00:40:56,800

there's a mountain the stones in the sky

1115

00:41:01,430 --> 00:40:59,839

the sun the moon the planets the stars

1116

00:41:03,510 --> 00:41:01,440

he just changed everything he said no no

1117

00:41:06,309 --> 00:41:03,520

no that's not the rightest thing there's

1118

00:41:08,550 --> 00:41:06,319

the sun and the planets

1119

00:41:11,030 --> 00:41:08,560

and the satellites and the planet is the

1120

00:41:13,349 --> 00:41:11,040

earth the moon so it's a completely

1121

00:41:14,630 --> 00:41:13,359

different rearrangement

1122

00:41:17,990 --> 00:41:14,640

of uh

1123

00:41:19,109 --> 00:41:18,000

how to organize the world this is this

1124

00:41:26,069 --> 00:41:19,119

to

1125

00:41:27,750 --> 00:41:26,079

um

1126

00:41:29,990 --> 00:41:27,760

you have to think

1127

00:41:31,349 --> 00:41:30,000

what you called philosophical uh

1128

00:41:33,750 --> 00:41:31,359

thinking that's the kind of thing that i

1129

00:41:35,030 --> 00:41:33,760

stand in the heisenberg did faraday did

1130

00:41:37,589 --> 00:41:35,040

boltzmann did

1131

00:41:38,390 --> 00:41:37,599

and that's not what is done

1132

00:41:40,630 --> 00:41:38,400

by

1133

00:41:42,710 --> 00:41:40,640

a lot of theoretical physics we just

1134

00:41:45,270 --> 00:41:42,720

think that the only thing you have to do

1135

00:41:46,710 --> 00:41:45,280

you know is to write another lagrangian

1136

00:41:49,109 --> 00:41:46,720

or

1137

00:41:51,589 --> 00:41:49,119

to write another you know

1138

00:41:52,950 --> 00:41:51,599

map between a hilbert space and other

1139

00:41:55,270 --> 00:41:52,960

hilbert space

1140

00:41:56,870 --> 00:41:55,280

or a new set of uh

1141

00:41:59,270 --> 00:41:56,880

uh uh

1142

00:42:01,990 --> 00:41:59,280

of scattering relations yeah and that's

1143

00:42:03,750 --> 00:42:02,000

sufficient is that because they want to

1144

00:42:06,150 --> 00:42:03,760

play it safe in a sense because when

1145

00:42:07,510 --> 00:42:06,160

you're just theorizing mathematically

1146

00:42:08,550 --> 00:42:07,520

it's easy to check where you're right

1147

00:42:10,230 --> 00:42:08,560

and wrong whereas if you're

1148

00:42:12,150 --> 00:42:10,240

philosophizing firstly you can delve

1149

00:42:14,630 --> 00:42:12,160

into pseudoscience and not be aware that

1150

00:42:17,510 --> 00:42:14,640

you are and it's much easier to wildly

1151

00:42:19,270 --> 00:42:17,520

speculate and be incorrect is that

1152

00:42:22,150 --> 00:42:19,280

what's behind it like what is behind the

1153

00:42:24,230 --> 00:42:22,160

aversion that you see

1154

00:42:26,550 --> 00:42:24,240

i think it's cultural i think it's

1155

00:42:29,270 --> 00:42:26,560

cultural i mean many of my colleagues

1156

00:42:32,630 --> 00:42:29,280

were raised in the

1157

00:42:34,950 --> 00:42:32,640

60s 70s 80s in a moment in which it

1158

00:42:37,109 --> 00:42:34,960

became very fashionable

1159

00:42:38,150 --> 00:42:37,119

uh to be anti-philosophical

1160

00:42:40,470 --> 00:42:38,160

um

1161

00:42:42,230 --> 00:42:40,480

this is after the war

1162

00:42:44,870 --> 00:42:42,240

uh

1163

00:42:46,630 --> 00:42:44,880

the center of science shifted the part

1164

00:42:48,630 --> 00:42:46,640

toward the united states from europe

1165

00:42:50,550 --> 00:42:48,640

where it was before

1166

00:42:51,829 --> 00:42:50,560

uh

1167

00:42:54,870 --> 00:42:51,839

a little bit

1168

00:42:57,349 --> 00:42:54,880

it's a success of the incredible success

1169

00:42:59,109 --> 00:42:57,359

of the physics of the

1170

00:43:01,990 --> 00:42:59,119

of the 30s

1171

00:43:03,589 --> 00:43:02,000

right the 20s 30s 10th i mean the first

1172

00:43:05,109 --> 00:43:03,599

half of the century

1173

00:43:06,550 --> 00:43:05,119

i mean the discovery of special

1174

00:43:09,349 --> 00:43:06,560

relativity generativity quantum

1175

00:43:12,390 --> 00:43:09,359

mechanics quantum field theory

1176

00:43:14,069 --> 00:43:12,400

was spectacular uh so good

1177

00:43:16,150 --> 00:43:14,079

that then somehow it made sense to say

1178

00:43:17,349 --> 00:43:16,160

well stop thinking let's use it

1179

00:43:19,109 --> 00:43:17,359

right i mean

1180

00:43:21,030 --> 00:43:19,119

we have all these tools that our

1181

00:43:23,430 --> 00:43:21,040

forefathers have discovered i mean

1182

00:43:25,349 --> 00:43:23,440

that's good let's use it and on the

1183

00:43:26,950 --> 00:43:25,359

basis think what has happened on the

1184

00:43:29,109 --> 00:43:26,960

basis of

1185

00:43:31,750 --> 00:43:29,119

quantum mechanics

1186

00:43:34,630 --> 00:43:31,760

uh boom you get you know

1187

00:43:37,109 --> 00:43:34,640

uh nuclear physics particle physics con

1188

00:43:40,390 --> 00:43:37,119

fundamental condensed matter uh

1189

00:43:42,870 --> 00:43:40,400

uh lasers uh

1190

00:43:44,550 --> 00:43:42,880

all sort of models just using the

1191

00:43:45,990 --> 00:43:44,560

equations with the dial by heisenberg

1192

00:43:48,150 --> 00:43:46,000

and company

1193

00:43:50,390 --> 00:43:48,160

and on the basis of special relativity

1194

00:43:52,230 --> 00:43:50,400

it took a little bit longer so the end

1195

00:43:54,390 --> 00:43:52,240

of the century but suddenly you know you

1196

00:43:56,630 --> 00:43:54,400

do relativistic astrophysics cosmology

1197

00:43:58,550 --> 00:43:56,640

black hole boom gravitational waves

1198

00:44:01,589 --> 00:43:58,560

fantastic just on

1199

00:44:02,390 --> 00:44:01,599

on the conceptual ground

1200

00:44:05,589 --> 00:44:02,400

uh

1201
00:44:08,069 --> 00:44:05,599
built in the 20s and 30s

1202
00:44:09,829 --> 00:44:08,079
so that the beginning of the century the

1203
00:44:11,910 --> 00:44:09,839
physicists were so good

1204
00:44:13,990 --> 00:44:11,920
that then people didn't have to think

1205
00:44:16,230 --> 00:44:14,000
for various decades just just

1206
00:44:18,309 --> 00:44:16,240
apply apply apply apply but then you

1207
00:44:20,630 --> 00:44:18,319
need to stop thinking for a while you

1208
00:44:22,230 --> 00:44:20,640
get used to not thinking you get used to

1209
00:44:24,150 --> 00:44:22,240
the idea that it's just mathematical

1210
00:44:26,309 --> 00:44:24,160
complications so if you're sufficiently

1211
00:44:28,230 --> 00:44:26,319
mathematically skilled

1212
00:44:29,670 --> 00:44:28,240
uh then you will do great physics and

1213
00:44:33,589 --> 00:44:29,680

there are people who are

1214

00:44:36,150 --> 00:44:33,599

spectacularly mathematically skilled and

1215

00:44:37,829 --> 00:44:36,160

do all the others like them like edwin

1216

00:44:40,069 --> 00:44:37,839

edward then is

1217

00:44:41,910 --> 00:44:40,079

a great mathematician if there's an

1218

00:44:43,750 --> 00:44:41,920

alien it's him

1219

00:44:46,710 --> 00:44:43,760

yeah but then he drew an entire

1220

00:44:49,109 --> 00:44:46,720

community in doing not physics because

1221

00:44:50,150 --> 00:44:49,119

if you think for a moment

1222

00:44:52,069 --> 00:44:50,160

whitten

1223

00:44:53,910 --> 00:44:52,079

has not got any real

1224

00:44:55,510 --> 00:44:53,920

physical result right

1225

00:44:57,030 --> 00:44:55,520

he has proven the positive energy

1226

00:44:58,870 --> 00:44:57,040

theorem

1227

00:45:00,550 --> 00:44:58,880

generativity which have improved before

1228

00:45:03,190 --> 00:45:00,560

and found a better proof of the positive

1229

00:45:04,870 --> 00:45:03,200

energy that's a mathematical game

1230

00:45:07,109 --> 00:45:04,880

and then he has you know speculated

1231

00:45:10,710 --> 00:45:07,119

about string theory and and

1232

00:45:15,670 --> 00:45:12,630

games over games that haven't produced

1233

00:45:19,510 --> 00:45:17,990

here's a fun question i'm curious if

1234

00:45:20,710 --> 00:45:19,520

you've thought much about it so it's a

1235

00:45:21,990 --> 00:45:20,720

def it's almost a question of

1236

00:45:23,589 --> 00:45:22,000

definitions

1237

00:45:25,109 --> 00:45:23,599

what is the universe so one answer is

1238

00:45:26,710 --> 00:45:25,119

the universe is everything that there is

1239

00:45:28,470 --> 00:45:26,720

so there cannot be an outside to the

1240

00:45:29,910 --> 00:45:28,480

universe by definition

1241

00:45:32,870 --> 00:45:29,920

by the way when i'm talking about

1242

00:45:34,870 --> 00:45:32,880

definitions it seems like that's there's

1243

00:45:36,150 --> 00:45:34,880

no point in talking about definitions

1244

00:45:37,589 --> 00:45:36,160

themselves are not profound because

1245

00:45:39,750 --> 00:45:37,599

they're tautologies

1246

00:45:41,910 --> 00:45:39,760

however when i was speaking to jorah

1247

00:45:44,150 --> 00:45:41,920

barnett and i'm not sure if you know him

1248

00:45:46,069 --> 00:45:44,160

he was saying kurt you want me to talk

1249

00:45:47,430 --> 00:45:46,079

about proofs and theorems what may be

1250

00:45:48,630 --> 00:45:47,440

more important are definitions and

1251
00:45:50,390 --> 00:45:48,640
techniques

1252
00:45:52,630 --> 00:45:50,400
so let's not

1253
00:45:54,470 --> 00:45:52,640
let's not demean definitions so firstly

1254
00:45:58,150 --> 00:45:54,480
what is the definition of the what is

1255
00:46:00,550 --> 00:45:58,160
the definition of the universe and then

1256
00:46:04,550 --> 00:46:00,560
where do the laws stand so are the laws

1257
00:46:07,270 --> 00:46:05,430
um

1258
00:46:09,750 --> 00:46:07,280
the different definitions of the of the

1259
00:46:10,630 --> 00:46:09,760
universe which are useful

1260
00:46:12,950 --> 00:46:10,640
um

1261
00:46:15,589 --> 00:46:12,960
and uh

1262
00:46:19,349 --> 00:46:15,599
it's good not to confuse them because we

1263
00:46:21,829 --> 00:46:19,359

we can use both of them um

1264

00:46:24,470 --> 00:46:21,839

in cosmology

1265

00:46:27,349 --> 00:46:24,480

which is a great discipline which have

1266

00:46:29,829 --> 00:46:27,359

made very important

1267

00:46:31,510 --> 00:46:29,839

had obtained great results in in the

1268

00:46:34,230 --> 00:46:31,520

last decades

1269

00:46:36,630 --> 00:46:34,240

uh the universe is not the totality of

1270

00:46:37,349 --> 00:46:36,640

thing the universe is the

1271

00:46:39,589 --> 00:46:37,359

uh

1272

00:46:43,430 --> 00:46:39,599

the description of what we see around us

1273

00:46:44,550 --> 00:46:43,440

as the largest scale that we look at it

1274

00:46:45,270 --> 00:46:44,560

so

1275

00:46:47,829 --> 00:46:45,280

the

1276

00:46:49,510 --> 00:46:47,839

that universe is a very small thing

1277

00:46:51,030 --> 00:46:49,520

it's lowercase u

1278

00:46:52,470 --> 00:46:51,040

it's just not looking at the details

1279

00:46:54,870 --> 00:46:52,480

it's what you see if you don't look at

1280

00:46:57,109 --> 00:46:54,880

the details but of course the details is

1281

00:46:59,030 --> 00:46:57,119

you and i are the details of that right

1282

00:47:01,349 --> 00:46:59,040

sure in that picture

1283

00:47:03,510 --> 00:47:01,359

uh that's very useful uh it's a very

1284

00:47:05,589 --> 00:47:03,520

strict definition of universe and you

1285

00:47:07,829 --> 00:47:05,599

describe it you know with a scale factor

1286

00:47:09,910 --> 00:47:07,839

that grows in the galaxy density and

1287

00:47:11,750 --> 00:47:09,920

this kind of things and dark matter and

1288

00:47:12,630 --> 00:47:11,760

and so on and so forth

1289

00:47:14,470 --> 00:47:12,640

and

1290

00:47:17,990 --> 00:47:14,480

that has turned out to be very very

1291

00:47:21,589 --> 00:47:18,000

useful because in fact we have learned

1292

00:47:24,309 --> 00:47:21,599

a credible story of what has happened

1293

00:47:25,829 --> 00:47:24,319

for 14 billion years in the past and

1294

00:47:27,510 --> 00:47:25,839

it's a very credible story i mean it's

1295

00:47:29,990 --> 00:47:27,520

very convincing once you study it say

1296

00:47:32,470 --> 00:47:30,000

yeah good we have evidence for that

1297

00:47:34,549 --> 00:47:32,480

but that's not the universe in the sense

1298

00:47:35,829 --> 00:47:34,559

that you were asking right it was

1299

00:47:38,390 --> 00:47:35,839

you were referring to a different

1300

00:47:40,630 --> 00:47:38,400

definition you would say which is all

1301
00:47:42,630 --> 00:47:40,640
there is so to say the totality yeah

1302
00:47:44,790 --> 00:47:42,640
tantamount to reality

1303
00:47:47,510 --> 00:47:44,800
yeah it's a the the

1304
00:47:49,109 --> 00:47:47,520
the the totality of the real things the

1305
00:47:50,790 --> 00:47:49,119
the totality of

1306
00:47:53,430 --> 00:47:50,800
of realities

1307
00:47:55,430 --> 00:47:53,440
uh i agree that definitions are

1308
00:47:56,630 --> 00:47:55,440
um

1309
00:47:58,870 --> 00:47:56,640
not

1310
00:48:01,270 --> 00:47:58,880
are important accusations yeah they're

1311
00:48:02,870 --> 00:48:01,280
not revealed they're not trivial i think

1312
00:48:04,790 --> 00:48:02,880
in some sense they are but they give

1313
00:48:07,589 --> 00:48:04,800

extreme insight yeah they're great

1314

00:48:09,349 --> 00:48:07,599

inside i mean think of the example of uh

1315

00:48:11,670 --> 00:48:09,359

i talk about copernicus right if you

1316

00:48:13,589 --> 00:48:11,680

start by a definition

1317

00:48:14,549 --> 00:48:13,599

you know of uh

1318

00:48:17,270 --> 00:48:14,559

earth

1319

00:48:19,190 --> 00:48:17,280

and and and the celestial bodies

1320

00:48:21,910 --> 00:48:19,200

you you you're done you killed

1321

00:48:24,150 --> 00:48:21,920

copernicus right you have to redefine

1322

00:48:26,069 --> 00:48:24,160

things you have to define planets versus

1323

00:48:27,910 --> 00:48:26,079

stars versus satellite and then you go

1324

00:48:30,390 --> 00:48:27,920

ahead without this definition you're

1325

00:48:31,349 --> 00:48:30,400

lost and then it's a very

1326

00:48:33,990 --> 00:48:31,359

uh

1327

00:48:35,510 --> 00:48:34,000

unintuitive definition planet i mean why

1328

00:48:37,109 --> 00:48:35,520

should i put in the same

1329

00:48:39,190 --> 00:48:37,119

category

1330

00:48:41,030 --> 00:48:39,200

the earth which i see around me you know

1331

00:48:44,150 --> 00:48:41,040

with the trees the mountain the sky the

1332

00:48:45,430 --> 00:48:44,160

birds and this little dot that move out

1333

00:48:47,030 --> 00:48:45,440

there which is venus these are

1334

00:48:48,790 --> 00:48:47,040

completely different things right no

1335

00:48:50,790 --> 00:48:48,800

they're not different things that's the

1336

00:48:52,470 --> 00:48:50,800

point you can define them together and

1337

00:48:54,950 --> 00:48:52,480

bingo you understand how the solar

1338

00:48:55,750 --> 00:48:54,960

system works so definitions are crucial

1339

00:48:59,510 --> 00:48:55,760

now

1340

00:49:03,910 --> 00:48:59,520

the tokenity thing it's a

1341

00:49:08,390 --> 00:49:06,470

because of relational quantum mechanics

1342

00:49:09,430 --> 00:49:08,400

ah so

1343

00:49:10,390 --> 00:49:09,440

uh

1344

00:49:13,670 --> 00:49:10,400

you see

1345

00:49:15,750 --> 00:49:13,680

if you buy malaysia quantum mechanics

1346

00:49:17,510 --> 00:49:15,760

you cannot ascribe properties the

1347

00:49:18,950 --> 00:49:17,520

totality of things because all

1348

00:49:21,510 --> 00:49:18,960

properties are really relative to

1349

00:49:23,349 --> 00:49:21,520

something else

1350

00:49:25,430 --> 00:49:23,359

so there is no

1351

00:49:27,349 --> 00:49:25,440

uh

1352

00:49:30,150 --> 00:49:27,359

there is no properties the universe has

1353

00:49:32,630 --> 00:49:30,160

no property in fact the universe is is

1354

00:49:33,910 --> 00:49:32,640

is not a system because a system is

1355

00:49:36,390 --> 00:49:33,920

something which can interact with

1356

00:49:38,470 --> 00:49:36,400

another system

1357

00:49:40,549 --> 00:49:38,480

to reveal its properties so to manifest

1358

00:49:41,990 --> 00:49:40,559

its properties

1359

00:49:42,950 --> 00:49:42,000

so you

1360

00:49:44,309 --> 00:49:42,960

if you buy a relational quantum

1361

00:49:46,390 --> 00:49:44,319

mechanics you only have descriptions of

1362

00:49:48,630 --> 00:49:46,400

the units from the inside so to say

1363

00:49:51,670 --> 00:49:48,640

just keep your universe as a whole you

1364

00:49:53,349 --> 00:49:52,470

so

1365

00:49:55,109 --> 00:49:53,359

uh

1366

00:49:57,589 --> 00:49:55,119

if you take serious relation quantum

1367

00:50:00,150 --> 00:49:57,599

mechanics and if you take seriously uh

1368

00:50:02,230 --> 00:50:00,160

what several philosophers today

1369

00:50:03,589 --> 00:50:02,240

are telling us

1370

00:50:06,069 --> 00:50:03,599

uh

1371

00:50:07,109 --> 00:50:06,079

i i think for instance janan ismail is

1372

00:50:08,390 --> 00:50:07,119

one of them

1373

00:50:09,990 --> 00:50:08,400

that

1374

00:50:11,510 --> 00:50:10,000

careful because every time we look at

1375

00:50:13,990 --> 00:50:11,520

the universe we'll look at universe from

1376
00:50:16,309 --> 00:50:14,000
the inside as being part of the universe

1377
00:50:17,990 --> 00:50:16,319
not from the outside and we often get

1378
00:50:20,230 --> 00:50:18,000
confused

1379
00:50:21,910 --> 00:50:20,240
because we we take it out of the picture

1380
00:50:23,910 --> 00:50:21,920
we think that we can

1381
00:50:26,470 --> 00:50:23,920
see that totality of things from the

1382
00:50:28,710 --> 00:50:26,480
outside and and and that's wrong and a

1383
00:50:29,750 --> 00:50:28,720
lot of confusion about i don't know free

1384
00:50:30,870 --> 00:50:29,760
will

1385
00:50:31,829 --> 00:50:30,880
um

1386
00:50:33,109 --> 00:50:31,839
or

1387
00:50:33,990 --> 00:50:33,119
um

1388
00:50:35,589 --> 00:50:34,000

or

1389

00:50:37,030 --> 00:50:35,599

what is knowledge

1390

00:50:38,790 --> 00:50:37,040

it's always thinking that we're outside

1391

00:50:41,030 --> 00:50:38,800

the universe that's the universe with

1392

00:50:43,430 --> 00:50:41,040

its stuff and we are out there looking

1393

00:50:45,349 --> 00:50:43,440

at that that's it's not true it's

1394

00:50:47,349 --> 00:50:45,359

factually not true

1395

00:50:49,589 --> 00:50:47,359

uh so

1396

00:50:52,230 --> 00:50:49,599

the universe in the sense of cosmology

1397

00:50:53,829 --> 00:50:52,240

is fine it's perfectly good thing but

1398

00:50:55,430 --> 00:50:53,839

the universe in the sense of the

1399

00:50:57,910 --> 00:50:55,440

totality of thing

1400

00:50:59,910 --> 00:50:57,920

uh it's uh it's a notion one should be

1401
00:51:01,349 --> 00:50:59,920
very careful with in my opinion for

1402
00:51:03,270 --> 00:51:01,359
instance one should not abstract

1403
00:51:04,230 --> 00:51:03,280
properties of the universe because how

1404
00:51:09,990 --> 00:51:04,240
do

1405
00:51:11,990 --> 00:51:10,000
any sense

1406
00:51:14,230 --> 00:51:12,000
there are many in principle problems

1407
00:51:16,230 --> 00:51:14,240
with conceiving of the universe well in

1408
00:51:18,150 --> 00:51:16,240
principle problems with science apply to

1409
00:51:19,910 --> 00:51:18,160
the universe as a whole because in

1410
00:51:21,670 --> 00:51:19,920
science we're constantly looking at

1411
00:51:23,750 --> 00:51:21,680
interacting parts within

1412
00:51:26,069 --> 00:51:23,760
and so then firstly how are you supposed

1413
00:51:28,309 --> 00:51:26,079

to perform an experiment twice on the

1414

00:51:30,870 --> 00:51:28,319

universe as a whole because the universe

1415

00:51:32,710 --> 00:51:30,880

is the entirety

1416

00:51:34,230 --> 00:51:32,720

okay except you might expand exactly on

1417

00:51:35,829 --> 00:51:34,240

that so what are the problems of the er

1418

00:51:36,950 --> 00:51:35,839

what else are the problems the in

1419

00:51:38,950 --> 00:51:36,960

principle problems not just

1420

00:51:40,549 --> 00:51:38,960

pragmatically we can't interact with all

1421

00:51:43,510 --> 00:51:40,559

of the universe the in principle

1422

00:51:44,950 --> 00:51:43,520

problems with conducting science or even

1423

00:51:47,670 --> 00:51:44,960

thought experiments about the universe

1424

00:51:52,390 --> 00:51:48,470

um

1425

00:51:55,430 --> 00:51:52,400

yes uh i can't but

1426
00:51:57,030 --> 00:51:55,440
before doing that let me reiterate uh uh

1427
00:51:58,950 --> 00:51:57,040
the distinction between the two

1428
00:52:00,710 --> 00:51:58,960
different meanings of of universe i mean

1429
00:52:03,430 --> 00:52:00,720
when the cosmologists

1430
00:52:05,670 --> 00:52:03,440
talk about the universe that's solid

1431
00:52:08,549 --> 00:52:05,680
science that's observable the universe

1432
00:52:10,309 --> 00:52:08,559
is what is the absolute universe okay

1433
00:52:13,109 --> 00:52:10,319
uh

1434
00:52:14,230 --> 00:52:13,119
the the universe is a cosmologist so

1435
00:52:15,589 --> 00:52:14,240
it's uh

1436
00:52:17,829 --> 00:52:15,599
what is it

1437
00:52:22,069 --> 00:52:17,839
it's the the large

1438
00:52:25,829 --> 00:52:23,750

so uh

1439

00:52:28,470 --> 00:52:25,839

we look at that universe from the

1440

00:52:31,190 --> 00:52:28,480

outside right we have a telescope with

1441

00:52:33,910 --> 00:52:31,200

the telescope we count galaxies

1442

00:52:37,510 --> 00:52:33,920

so the telescope and us is the observer

1443

00:52:39,109 --> 00:52:37,520

the the galaxy's counted it's the system

1444

00:52:41,670 --> 00:52:39,119

we're observing

1445

00:52:44,390 --> 00:52:41,680

so it's fine it's it's perfectly fine we

1446

00:52:46,390 --> 00:52:44,400

can see this galaxy we see how much

1447

00:52:47,829 --> 00:52:46,400

they're moving apart from us we can

1448

00:52:50,630 --> 00:52:47,839

trace back

1449

00:52:53,430 --> 00:52:50,640

how compressed they were in the before

1450

00:52:54,470 --> 00:52:53,440

we have a system we can model it

1451

00:52:56,309 --> 00:52:54,480

um

1452

00:53:00,470 --> 00:52:56,319

and we're observing these degrees of

1453

00:53:04,630 --> 00:53:01,750

from the outside in the sense that we

1454

00:53:05,510 --> 00:53:04,640

are not part of those degrees of freedom

1455

00:53:10,230 --> 00:53:05,520

we are

1456

00:53:12,309 --> 00:53:10,240

it from not being one of them it's like

1457

00:53:14,150 --> 00:53:12,319

if we were i'm in this room and i study

1458

00:53:15,990 --> 00:53:14,160

the air of this room i can be inside the

1459

00:53:17,910 --> 00:53:16,000

room but i'm not there

1460

00:53:20,790 --> 00:53:17,920

okay

1461

00:53:24,870 --> 00:53:20,800

so so that's fine on the other hand

1462

00:53:27,430 --> 00:53:24,880

uh the idea of describing the totality

1463

00:53:29,030 --> 00:53:27,440

of thing of ascribing a wave function

1464

00:53:31,270 --> 00:53:29,040

for instance through the totality of

1465

00:53:33,109 --> 00:53:31,280

things

1466

00:53:33,990 --> 00:53:33,119

which is common

1467

00:53:37,190 --> 00:53:34,000

uh

1468

00:53:39,190 --> 00:53:37,200

i i don't think it's a good idea

1469

00:53:42,309 --> 00:53:39,200

because uh

1470

00:53:45,910 --> 00:53:42,319

let's be real specific the wave function

1471

00:53:49,030 --> 00:53:45,920

of an object a wave function of this pen

1472

00:53:51,510 --> 00:53:49,040

uh it's a way of computing

1473

00:53:54,309 --> 00:53:51,520

where this pen is gonna

1474

00:53:57,990 --> 00:53:54,319

show up with respect to me next

1475

00:54:00,470 --> 00:53:58,000

right right so

1476

00:54:03,109 --> 00:54:00,480

when when i'm in a laboratory and and

1477

00:54:05,990 --> 00:54:03,119

and and and do some quantum measurement

1478

00:54:08,950 --> 00:54:06,000

uh and and i use the wave function the

1479

00:54:10,630 --> 00:54:08,960

quantum state for uh predicting what i'm

1480

00:54:13,430 --> 00:54:10,640

going to see

1481

00:54:15,430 --> 00:54:13,440

uh i i'm deducing this wave function

1482

00:54:18,309 --> 00:54:15,440

from what i saw

1483

00:54:20,069 --> 00:54:18,319

okay i've seen this pen the spin of this

1484

00:54:21,990 --> 00:54:20,079

particle in one way goes to some

1485

00:54:23,750 --> 00:54:22,000

apparatus and i have the

1486

00:54:25,670 --> 00:54:23,760

probability of the

1487

00:54:28,069 --> 00:54:25,680

spin being this way or that way after

1488

00:54:30,230 --> 00:54:28,079

the pentagon supply that's a typical

1489

00:54:32,309 --> 00:54:30,240

uh super simplified calculation and to

1490

00:54:34,150 --> 00:54:32,319

do this calculation i use the quantum

1491

00:54:36,470 --> 00:54:34,160

wave function of this

1492

00:54:37,910 --> 00:54:36,480

of this uh of this pen but what is this

1493

00:54:39,670 --> 00:54:37,920

quantum wave wavefunction

1494

00:54:42,710 --> 00:54:39,680

is what i

1495

00:54:44,230 --> 00:54:42,720

know about the pen

1496

00:54:46,230 --> 00:54:44,240

and it's a

1497

00:54:47,990 --> 00:54:46,240

a description

1498

00:54:49,750 --> 00:54:48,000

of what should i expect of the pet so

1499

00:54:51,349 --> 00:54:49,760

it's something that regard the pen and

1500

00:54:53,270 --> 00:54:51,359

me

1501

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

it's a it's a relative state and the

1502

00:54:56,950 --> 00:54:54,720

person who

1503

00:54:57,829 --> 00:54:56,960

first has understood

1504

00:54:59,510 --> 00:54:57,839

that

1505

00:55:00,950 --> 00:54:59,520

when you use quantum states in quantum

1506

00:55:03,190 --> 00:55:00,960

mechanics we always talk about relative

1507

00:55:04,230 --> 00:55:03,200

space is evident

1508

00:55:05,430 --> 00:55:04,240

uh

1509

00:55:08,309 --> 00:55:05,440

in

1510

00:55:09,910 --> 00:55:08,319

several decades ago uh everett has

1511

00:55:11,750 --> 00:55:09,920

understood that states are relative

1512

00:55:13,510 --> 00:55:11,760

states so the quantum state of an object

1513

00:55:15,829 --> 00:55:13,520

is always relative to another object

1514

00:55:16,950 --> 00:55:15,839

okay this is a state is a relational

1515

00:55:19,349 --> 00:55:16,960

thing

1516

00:55:20,950 --> 00:55:19,359

and once you understand that

1517

00:55:22,950 --> 00:55:20,960

clearly

1518

00:55:25,109 --> 00:55:22,960

the totality of thing does not does not

1519

00:55:27,030 --> 00:55:25,119

have a quantum state

1520

00:55:29,430 --> 00:55:27,040

because unless you believe there is god

1521

00:55:31,670 --> 00:55:29,440

then god thinks do quantum experiments

1522

00:55:33,670 --> 00:55:31,680

on on the but then god is not part of

1523

00:55:36,069 --> 00:55:33,680

the universe

1524

00:55:39,270 --> 00:55:36,079

then you lose n god together don't have

1525

00:55:39,990 --> 00:55:39,280

a quantum state right so um

1526
00:55:49,270 --> 00:55:40,000
the

1527
00:55:52,470 --> 00:55:49,280
everything um i think is not something

1528
00:55:55,190 --> 00:55:52,480
that should uh enter in is not a useful

1529
00:55:58,230 --> 00:55:55,200
notion in physics the

1530
00:56:00,710 --> 00:55:58,240
way functions are relational notions

1531
00:56:05,190 --> 00:56:00,720
um that connect a system with another

1532
00:56:08,870 --> 00:56:06,870
okay so three thoughts occur to me i'm

1533
00:56:10,230 --> 00:56:08,880
gonna say them and then just so that i

1534
00:56:11,670 --> 00:56:10,240
don't forget them and then we can tackle

1535
00:56:13,589 --> 00:56:11,680
them one by one

1536
00:56:15,589 --> 00:56:13,599
okay so number one you mentioned everett

1537
00:56:17,670 --> 00:56:15,599
and i believe everett was a proponent of

1538
00:56:20,390 --> 00:56:17,680

many worlds i'm in i'm not sure about

1539

00:56:22,630 --> 00:56:20,400

that so okay you nodding your head so if

1540

00:56:24,870 --> 00:56:22,640

that's the case well if he

1541

00:56:26,470 --> 00:56:24,880

in many ways realized this relative

1542

00:56:28,150 --> 00:56:26,480

notion of quantum mechanics the

1543

00:56:29,670 --> 00:56:28,160

relational notion so why did he move to

1544

00:56:31,430 --> 00:56:29,680

many worlds so that's one i'm going to

1545

00:56:33,510 --> 00:56:31,440

say the others so don't forget them

1546

00:56:35,030 --> 00:56:33,520

number two

1547

00:56:37,109 --> 00:56:35,040

when we're speaking even right now just

1548

00:56:38,309 --> 00:56:37,119

with the english language it seems

1549

00:56:40,549 --> 00:56:38,319

incredibly

1550

00:56:42,230 --> 00:56:40,559

misleading because as soon as i say i

1551
00:56:44,630 --> 00:56:42,240
look right there i use the word i and

1552
00:56:46,549 --> 00:56:44,640
you also mentioned as many philosophers

1553
00:56:48,230 --> 00:56:46,559
come to similar conclusions well what is

1554
00:56:49,990 --> 00:56:48,240
this i what is behind so as soon as you

1555
00:56:52,470 --> 00:56:50,000
start to analyze any word as soon as i

1556
00:56:54,630 --> 00:56:52,480
say cup well what is the cup

1557
00:56:56,870 --> 00:56:54,640
okay you we realize that

1558
00:56:59,430 --> 00:56:56,880
every everyday language is beguiling so

1559
00:57:00,630 --> 00:56:59,440
it can't actually describe reality no

1560
00:57:02,950 --> 00:57:00,640
i'm wondering

1561
00:57:04,789 --> 00:57:02,960
is there something similar with math

1562
00:57:07,349 --> 00:57:04,799
do you believe that math is somehow

1563
00:57:09,990 --> 00:57:07,359

exempt from this that math is actually

1564

00:57:11,829 --> 00:57:10,000

can't math actually can describe reality

1565

00:57:13,829 --> 00:57:11,839

so that's my number two don't worry i've

1566

00:57:15,750 --> 00:57:13,839

got all these in my head and the number

1567

00:57:17,510 --> 00:57:15,760

three was i didn't hear

1568

00:57:19,990 --> 00:57:17,520

an answer to

1569

00:57:21,910 --> 00:57:20,000

whether or not the laws themselves like

1570

00:57:24,549 --> 00:57:21,920

the rules of the game are part of the

1571

00:57:26,710 --> 00:57:24,559

game or in other words

1572

00:57:28,870 --> 00:57:26,720

if when one thinks of reality as a whole

1573

00:57:30,789 --> 00:57:28,880

is one also supposed to think of

1574

00:57:32,630 --> 00:57:30,799

the laws that reality operate by as

1575

00:57:35,109 --> 00:57:32,640

being a part of reality so let's get to

1576

00:57:37,510 --> 00:57:35,119

number one why did everett come to

1577

00:57:41,910 --> 00:57:37,520

alternate conclusions yes um so the

1578

00:57:46,309 --> 00:57:44,789

you said everett is is considered the uh

1579

00:57:49,190 --> 00:57:46,319

sort of the beginning of a many world

1580

00:57:52,309 --> 00:57:49,200

interpretation that's correct

1581

00:57:53,990 --> 00:57:52,319

no that's correct and uh in fact uh many

1582

00:57:55,990 --> 00:57:54,000

people who like the many world

1583

00:57:58,150 --> 00:57:56,000

interpretation called all calls this

1584

00:57:59,190 --> 00:57:58,160

inspiration also the everett interpreter

1585

00:58:01,349 --> 00:57:59,200

right i think that's where i got it

1586

00:58:02,309 --> 00:58:01,359

called himself

1587

00:58:03,990 --> 00:58:02,319

um

1588

00:58:07,589 --> 00:58:04,000

everett wrote a

1589

00:58:09,349 --> 00:58:07,599

a a fantastic paper plus other uh

1590

00:58:10,950 --> 00:58:09,359

other things in which there are a number

1591

00:58:14,549 --> 00:58:10,960

of ideas

1592

00:58:16,950 --> 00:58:14,559

um we also have the um

1593

00:58:18,470 --> 00:58:16,960

the thesis that everett wrote when he

1594

00:58:19,670 --> 00:58:18,480

left physics

1595

00:58:20,710 --> 00:58:19,680

um

1596

00:58:23,990 --> 00:58:20,720

so

1597

00:58:26,710 --> 00:58:24,000

one question it might be what he himself

1598

00:58:28,069 --> 00:58:26,720

actually thought about quantum mechanics

1599

00:58:29,349 --> 00:58:28,079

but that's not a very interesting

1600

00:58:31,190 --> 00:58:29,359

question i mean

1601
00:58:32,789 --> 00:58:31,200
what is interesting is not what actually

1602
00:58:34,789 --> 00:58:32,799
people thought at some time what is

1603
00:58:36,710 --> 00:58:34,799
interesting what can we do with the with

1604
00:58:39,190 --> 00:58:36,720
their ideas and their text

1605
00:58:41,589 --> 00:58:39,200
and everett has introduced this notion

1606
00:58:43,109 --> 00:58:41,599
of uh

1607
00:58:47,190 --> 00:58:43,119
relational states

1608
00:58:48,549 --> 00:58:47,200
which i think is spectacularly good

1609
00:58:51,190 --> 00:58:48,559
and one way

1610
00:58:53,349 --> 00:58:51,200
of developing that idea is relational

1611
00:58:56,230 --> 00:58:53,359
quantum mechanics namely thinking that

1612
00:58:59,430 --> 00:58:56,240
properties are all relational

1613
00:59:01,349 --> 00:58:59,440

another way of developing that idea

1614

00:59:03,349 --> 00:59:01,359

is the many world interpretation so if

1615

00:59:05,510 --> 00:59:03,359

you want from evidence you can branch

1616

00:59:07,589 --> 00:59:05,520

off to two possible

1617

00:59:08,630 --> 00:59:07,599

uh directions of thinking about quantum

1618

00:59:10,470 --> 00:59:08,640

theory

1619

00:59:12,789 --> 00:59:10,480

the mineral interpretation

1620

00:59:14,470 --> 00:59:12,799

it goes the opposite direction than

1621

00:59:17,990 --> 00:59:14,480

relational quantum mechanics even if it

1622

00:59:20,390 --> 00:59:18,000

has this common idea that properties are

1623

00:59:22,309 --> 00:59:20,400

relatively they

1624

00:59:24,470 --> 00:59:22,319

many more people will say to to system

1625

00:59:27,670 --> 00:59:24,480

into branches

1626

00:59:29,270 --> 00:59:27,680

um the the main world idea is is is

1627

00:59:31,910 --> 00:59:29,280

contrary is to take

1628

00:59:34,069 --> 00:59:31,920

the wave functional universe seriously

1629

00:59:35,910 --> 00:59:34,079

and think that this is all there is this

1630

00:59:37,270 --> 00:59:35,920

wave function of the universe this

1631

00:59:39,910 --> 00:59:37,280

overall

1632

00:59:41,349 --> 00:59:39,920

uh super quantum state in which we are

1633

00:59:43,750 --> 00:59:41,359

sitting

1634

00:59:46,309 --> 00:59:43,760

and uh um

1635

00:59:48,710 --> 00:59:46,319

and all the rest has to be sort of

1636

00:59:49,829 --> 00:59:48,720

extracted from

1637

00:59:51,750 --> 00:59:49,839

uh

1638

00:59:52,549 --> 00:59:51,760

derived from from

1639

00:59:54,630 --> 00:59:52,559

from

1640

00:59:56,309 --> 00:59:54,640

this wave function of the universe

1641

00:59:58,390 --> 00:59:56,319

this wave function of everything and

1642

01:00:01,430 --> 00:59:58,400

that's a real stuff that's sort of the

1643

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

main it was interpretation um it's very

1644

01:00:04,710 --> 01:00:02,799

interesting

1645

01:00:05,349 --> 01:00:04,720

i don't like it very much i think that

1646

01:00:06,630 --> 01:00:05,359

as

1647

01:00:08,230 --> 01:00:06,640

i said at the beginning each

1648

01:00:09,910 --> 01:00:08,240

interpretation is a cost and i don't

1649

01:00:12,390 --> 01:00:09,920

think it's a cost

1650

01:00:15,510 --> 01:00:12,400

that is bringing us ahead

1651
01:00:18,630 --> 01:00:15,520
because uh you know if you think

1652
01:00:18,900 --> 01:00:18,640
uh if you if you take it seriously

1653
01:00:20,230 --> 01:00:18,910
um

1654
01:00:22,150 --> 01:00:20,240
[Music]

1655
01:00:25,030 --> 01:00:22,160
the universe is sort of constantly

1656
01:00:27,430 --> 01:00:25,040
splitting in multiple

1657
01:00:30,150 --> 01:00:27,440
branches of this big wave function

1658
01:00:32,230 --> 01:00:30,160
where you and i are copied millions and

1659
01:00:33,829 --> 01:00:32,240
millions of times

1660
01:00:36,390 --> 01:00:33,839
uh so you always think that there is the

1661
01:00:38,470 --> 01:00:36,400
other the other the other copies of

1662
01:00:39,670 --> 01:00:38,480
non-realized

1663
01:00:41,750 --> 01:00:39,680

uh yeah

1664

01:00:43,670 --> 01:00:41,760

you might think that way but it's

1665

01:00:45,190 --> 01:00:43,680

nothing wrong but i don't think it's

1666

01:00:47,510 --> 01:00:45,200

useful

1667

01:00:49,990 --> 01:00:47,520

okay so then number two was about the

1668

01:00:50,950 --> 01:00:50,000

limitations of language and then do you

1669

01:00:53,190 --> 01:00:50,960

see

1670

01:00:54,630 --> 01:00:53,200

any similar limitations to

1671

01:00:57,670 --> 01:00:54,640

the language of mathematics to the

1672

01:01:00,549 --> 01:00:57,680

degree you can call it a language

1673

01:01:03,349 --> 01:01:00,559

as describing the universe

1674

01:01:05,990 --> 01:01:03,359

i i don't think mathematics

1675

01:01:06,380 --> 01:01:06,000

alone is sufficient

1676

01:01:09,750 --> 01:01:06,390

um

1677

01:01:14,069 --> 01:01:12,630

i mean i i listen and i read max tech

1678

01:01:15,990 --> 01:01:14,079

mark but nevertheless i think that

1679

01:01:17,990 --> 01:01:16,000

between mathematics and reality there is

1680

01:01:19,190 --> 01:01:18,000

a gap

1681

01:01:21,349 --> 01:01:19,200

um

1682

01:01:24,309 --> 01:01:21,359

i think mathematics is not out there

1683

01:01:27,190 --> 01:01:24,319

mathematics is a game we play fantastic

1684

01:01:29,030 --> 01:01:27,200

game play super useful

1685

01:01:31,430 --> 01:01:29,040

that we extract from

1686

01:01:33,750 --> 01:01:31,440

from reality

1687

01:01:34,630 --> 01:01:33,760

but i think that

1688

01:01:36,470 --> 01:01:34,640

um

1689

01:01:38,150 --> 01:01:36,480

if i use case but if i think case by

1690

01:01:39,750 --> 01:01:38,160

case the mathematics that describe a

1691

01:01:40,630 --> 01:01:39,760

pendulum

1692

01:01:43,589 --> 01:01:40,640

okay

1693

01:01:45,510 --> 01:01:43,599

which we learn at school when we study

1694

01:01:47,349 --> 01:01:45,520

you know the the differential equation

1695

01:01:49,109 --> 01:01:47,359

of a pendulum the solution sine or

1696

01:01:50,789 --> 01:01:49,119

cosine

1697

01:01:53,190 --> 01:01:50,799

it's beautiful mathematic but it's not

1698

01:01:55,109 --> 01:01:53,200

pendulum

1699

01:01:57,190 --> 01:01:55,119

okay now you can say okay because

1700

01:01:59,510 --> 01:01:57,200

something is missing in a real pendulum

1701
01:02:02,309 --> 01:01:59,520
there's also this also this also this

1702
01:02:03,670 --> 01:02:02,319
but i think it it it stays like that i

1703
01:02:05,349 --> 01:02:03,680
mean you refine your model your

1704
01:02:07,270 --> 01:02:05,359
mathematical model

1705
01:02:08,950 --> 01:02:07,280
but there's a jump

1706
01:02:15,330 --> 01:02:08,960
between

1707
01:02:18,150 --> 01:02:16,710
[Music]

1708
01:02:19,990 --> 01:02:18,160
when you do

1709
01:02:21,829 --> 01:02:20,000
you get to complicated theories like

1710
01:02:23,829 --> 01:02:21,839
current physical theory standard model

1711
01:02:25,910 --> 01:02:23,839
generativity

1712
01:02:27,750 --> 01:02:25,920
it's even stronger i mean these

1713
01:02:29,589 --> 01:02:27,760

equations need to be interpreted need to

1714

01:02:32,789 --> 01:02:29,599

be connected

1715

01:02:34,950 --> 01:02:32,799

to what we see and this connection

1716

01:02:36,630 --> 01:02:34,960

it's part of the story and it's even the

1717

01:02:38,390 --> 01:02:36,640

most interesting part of the story so to

1718

01:02:40,390 --> 01:02:38,400

say it's not sufficient to have

1719

01:02:41,910 --> 01:02:40,400

questions at that i mean what does it

1720

01:02:43,750 --> 01:02:41,920

mean you have a question we have all

1721

01:02:45,270 --> 01:02:43,760

space of solutions

1722

01:02:47,270 --> 01:02:45,280

now max stigma could say okay that's

1723

01:02:49,510 --> 01:02:47,280

reality that's over all the reason we

1724

01:02:50,710 --> 01:02:49,520

just happen to be into one

1725

01:02:53,190 --> 01:02:50,720

um

1726

01:02:55,430 --> 01:02:53,200

but which one that's that's uh

1727

01:02:58,390 --> 01:02:55,440

that's the connection to reality

1728

01:03:00,390 --> 01:02:58,400

so this means that also mathematics has

1729

01:03:02,470 --> 01:03:00,400

the same problem that you are describing

1730

01:03:04,470 --> 01:03:02,480

i mean our

1731

01:03:06,549 --> 01:03:04,480

everyday language

1732

01:03:09,109 --> 01:03:06,559

might be inappropriate

1733

01:03:10,950 --> 01:03:09,119

to describe the world

1734

01:03:13,589 --> 01:03:10,960

we have to refine it we have to invent

1735

01:03:15,750 --> 01:03:13,599

the new new words planet which include

1736

01:03:17,430 --> 01:03:15,760

the earth

1737

01:03:19,109 --> 01:03:17,440

but the same is true with mathematics i

1738

01:03:21,190 --> 01:03:19,119

mean the fact of writing a big

1739

01:03:22,950 --> 01:03:21,200

mathematical equations is completely

1740

01:03:25,029 --> 01:03:22,960

insufficient

1741

01:03:25,829 --> 01:03:25,039

unless we

1742

01:03:27,349 --> 01:03:25,839

uh

1743

01:03:30,470 --> 01:03:27,359

interpret

1744

01:03:33,270 --> 01:03:30,480

it's its ingredients and we connect it

1745

01:03:34,950 --> 01:03:33,280

to the world into our experience

1746

01:03:36,950 --> 01:03:34,960

so the

1747

01:03:39,029 --> 01:03:36,960

the indeterminacy of language that you

1748

01:03:40,309 --> 01:03:39,039

were referring to we have to struggle

1749

01:03:48,630 --> 01:03:40,319

with

1750

01:03:51,109 --> 01:03:48,640

we should not

1751

01:03:53,270 --> 01:03:51,119

uh think that we can

1752

01:03:55,910 --> 01:03:53,280

you know get to the bottom of the story

1753

01:03:58,069 --> 01:03:55,920

and have a perfectly

1754

01:04:01,109 --> 01:03:58,079

logical perfect language description of

1755

01:04:02,470 --> 01:04:01,119

reality and everything is clarified

1756

01:04:05,430 --> 01:04:02,480

we're not there

1757

01:04:06,789 --> 01:04:05,440

completely not there by by the zillions

1758

01:04:08,630 --> 01:04:06,799

of miles

1759

01:04:10,549 --> 01:04:08,640

we are in a big mess in which we see a

1760

01:04:12,789 --> 01:04:10,559

complicated world we understand part of

1761

01:04:15,109 --> 01:04:12,799

it we understand some regularities of it

1762

01:04:15,990 --> 01:04:15,119

and we call this our physics

1763

01:04:19,109 --> 01:04:16,000

um

1764

01:04:21,430 --> 01:04:19,119

and this this takes me to the

1765

01:04:22,789 --> 01:04:21,440

the third question about the laws

1766

01:04:23,910 --> 01:04:22,799

yeah to the third question about the

1767

01:04:27,270 --> 01:04:23,920

laws

1768

01:04:29,829 --> 01:04:27,280

uh which you asked before um

1769

01:04:31,349 --> 01:04:29,839

i think that what laws are

1770

01:04:35,029 --> 01:04:31,359

as far as we know

1771

01:04:36,069 --> 01:04:35,039

just uh irregularities so

1772

01:04:42,150 --> 01:04:36,079

we

1773

01:04:44,870 --> 01:04:42,160

uh

1774

01:04:46,870 --> 01:04:44,880

nature works so phenomenal not just with

1775

01:04:47,589 --> 01:04:46,880

respect to us the phenomena with respect

1776

01:04:50,230 --> 01:04:47,599

to

1777

01:04:53,190 --> 01:04:50,240

saturn when saturn when something hits

1778

01:04:57,430 --> 01:04:53,200

saturn this saturn it's it's hit by by a

1779

01:04:59,349 --> 01:04:57,440

meteorite like i'm hit by your voice

1780

01:05:00,390 --> 01:04:59,359

uh

1781

01:05:02,710 --> 01:05:00,400

the world

1782

01:05:05,349 --> 01:05:02,720

it's it's it's it's this is a fact it's

1783

01:05:06,950 --> 01:05:05,359

a mixture of two things

1784

01:05:09,109 --> 01:05:06,960

of uh

1785

01:05:10,710 --> 01:05:09,119

uh contingent thing that we have no idea

1786

01:05:12,549 --> 01:05:10,720

how to predict

1787

01:05:14,470 --> 01:05:12,559

and predictable things

1788

01:05:17,510 --> 01:05:14,480

it's always been like that right i don't

1789

01:05:19,750 --> 01:05:17,520

know who will bring my phone next but i

1790

01:05:21,910 --> 01:05:19,760

know that tomorrow the sun will rise

1791

01:05:22,789 --> 01:05:21,920

i know exactly what time it will rise

1792

01:05:24,470 --> 01:05:22,799

okay

1793

01:05:26,870 --> 01:05:24,480

so there's a part of the world which is

1794

01:05:29,270 --> 01:05:26,880

incredibly easy to predict

1795

01:05:31,270 --> 01:05:29,280

i mean if i let this thing fall i know

1796

01:05:32,789 --> 01:05:31,280

it will go down and not up i can predict

1797

01:05:34,150 --> 01:05:32,799

it i can bet of it and i'm going to win

1798

01:05:36,470 --> 01:05:34,160

them it

1799

01:05:37,990 --> 01:05:36,480

so there's a huge part of the

1800

01:05:39,190 --> 01:05:38,000

world which is predictable and there's a

1801

01:05:40,549 --> 01:05:39,200

huge part of the world which is

1802

01:05:42,710 --> 01:05:40,559

unpredictable

1803

01:05:44,390 --> 01:05:42,720

so we organized that in our science and

1804

01:05:47,109 --> 01:05:44,400

physics in particular and we call the

1805

01:05:49,029 --> 01:05:47,119

predictable story the laws

1806

01:05:50,870 --> 01:05:49,039

that we found out okay this what did

1807

01:05:52,470 --> 01:05:50,880

this i mean we found some regularity

1808

01:05:54,630 --> 01:05:52,480

very very good very strong regular i

1809

01:05:56,390 --> 01:05:54,640

think we call the laws

1810

01:05:59,349 --> 01:05:56,400

and we

1811

01:06:01,670 --> 01:05:59,359

have unpredictable part which we call

1812

01:06:04,069 --> 01:06:01,680

initial conditions or

1813

01:06:06,870 --> 01:06:04,079

uh you know and determination in quantum

1814

01:06:09,270 --> 01:06:06,880

mechanics we give other names

1815

01:06:10,710 --> 01:06:09,280

um to the fact that uh definitely the

1816

01:06:12,549 --> 01:06:10,720

laws are not sufficient to describe the

1817

01:06:14,309 --> 01:06:12,559

world right or obviously because a

1818

01:06:18,390 --> 01:06:14,319

single law has many solutions we don't

1819

01:06:22,390 --> 01:06:19,829

as an aside

1820

01:06:23,750 --> 01:06:22,400

you hear people say well copernicus

1821

01:06:25,430 --> 01:06:23,760

realized that the earth revolves around

1822

01:06:27,910 --> 01:06:25,440

the sun isn't one of the points of

1823

01:06:29,990 --> 01:06:27,920

general relativity to say that you can

1824

01:06:31,670 --> 01:06:30,000

actually view it both ways you can just

1825

01:06:33,190 --> 01:06:31,680

change the coordinates according to

1826

01:06:35,190 --> 01:06:33,200

system technically

1827

01:06:36,390 --> 01:06:35,200

okay yeah you're right

1828

01:06:38,150 --> 01:06:36,400

yes you're right

1829

01:06:40,630 --> 01:06:38,160

you're right in fact

1830

01:06:44,470 --> 01:06:42,309

in fact

1831

01:06:49,270 --> 01:06:44,480

if you ask don't put this way because i

1832

01:06:53,430 --> 01:06:51,510

the question um

1833

01:06:55,510 --> 01:06:53,440

is is the earth going around the sun or

1834

01:06:56,390 --> 01:06:55,520

the sun going around the earth

1835

01:06:57,910 --> 01:06:56,400

uh

1836

01:07:03,029 --> 01:06:57,920

let me put a simpler question is the

1837

01:07:06,549 --> 01:07:05,109

is that a scientific question yes of

1838

01:07:09,109 --> 01:07:06,559

course it's a scientific question right

1839

01:07:11,349 --> 01:07:09,119

in fact jumping out from this

1840

01:07:12,789 --> 01:07:11,359

idea that the center center is what

1841

01:07:15,430 --> 01:07:12,799

allowed us to do

1842

01:07:17,829 --> 01:07:15,440

newtonian physics kepler and everything

1843

01:07:19,510 --> 01:07:17,839

i mean we understood so much

1844

01:07:22,069 --> 01:07:19,520

but let's ask let's think about this

1845

01:07:24,870 --> 01:07:22,079

question can it be measured whether the

1846

01:07:26,950 --> 01:07:24,880

earth is a central universe or not no

1847

01:07:29,829 --> 01:07:26,960

right there's no way to measure it we

1848

01:07:32,069 --> 01:07:29,839

have no no way of thinking what is the

1849

01:07:33,670 --> 01:07:32,079

center of the universe

1850

01:07:35,670 --> 01:07:33,680

but it's not

1851

01:07:37,029 --> 01:07:35,680

something which is uh directly

1852

01:07:38,630 --> 01:07:37,039

measurable

1853

01:07:42,630 --> 01:07:38,640

and i think this is interesting because

1854

01:07:44,470 --> 01:07:42,640

it shows that science is not just about

1855

01:07:46,470 --> 01:07:44,480

measurable things

1856

01:07:49,829 --> 01:07:46,480

science as i said before is about

1857

01:07:51,829 --> 01:07:49,839

organizing your thinking in some way

1858

01:07:52,950 --> 01:07:51,839

so if you organize your thinking as the

1859

01:07:55,029 --> 01:07:52,960

earth

1860

01:07:56,549 --> 01:07:55,039

not moving everything going around it in

1861

01:07:57,990 --> 01:07:56,559

some way

1862

01:07:59,829 --> 01:07:58,000

you're just messing up your your

1863

01:08:02,069 --> 01:07:59,839

understanding it's just it's too

1864

01:08:04,150 --> 01:08:02,079

complicated you're not getting out of it

1865

01:08:05,829 --> 01:08:04,160

but if you start to organize things

1866

01:08:07,670 --> 01:08:05,839

first is this is

1867

01:08:09,670 --> 01:08:07,680

the sun and then say oh no actually it's

1868

01:08:11,190 --> 01:08:09,680

not the sun the sun is also moving and

1869

01:08:12,710 --> 01:08:11,200

then you better again

1870

01:08:14,069 --> 01:08:12,720

um

1871

01:08:16,709 --> 01:08:14,079

there's no center in the universe

1872

01:08:18,390 --> 01:08:16,719

there's no preferred reference frame um

1873

01:08:19,829 --> 01:08:18,400

some up properties some of the other

1874

01:08:21,110 --> 01:08:19,839

properties

1875

01:08:24,390 --> 01:08:21,120

you

1876
01:08:27,030 --> 01:08:24,400
better ways and of course the previous

1877
01:08:29,510 --> 01:08:27,040
one looked a little bit naive always

1878
01:08:30,950 --> 01:08:29,520
okay it's not true that the sun is the

1879
01:08:32,550 --> 01:08:30,960
center of india is going around it's

1880
01:08:34,470 --> 01:08:32,560
more complicated story like the one you

1881
01:08:35,829 --> 01:08:34,480
said it's more correct

1882
01:08:37,189 --> 01:08:35,839
um

1883
01:08:38,709 --> 01:08:37,199
so

1884
01:08:40,390 --> 01:08:38,719
science is not about

1885
01:08:44,070 --> 01:08:40,400
true or false

1886
01:08:46,390 --> 01:08:44,080
statement

1887
01:08:48,309 --> 01:08:46,400
it's about the best way we found so far

1888
01:08:50,550 --> 01:08:48,319

for thinking about the universe

1889

01:08:52,470 --> 01:08:50,560

the one that allows us to understand

1890

01:08:54,149 --> 01:08:52,480

things to predict thing to write laws

1891

01:08:55,990 --> 01:08:54,159

more easily

1892

01:08:58,149 --> 01:08:56,000

i think me and you think

1893

01:08:59,269 --> 01:08:58,159

quite alike and i heard a hint of it

1894

01:09:01,110 --> 01:08:59,279

when you said that there are different

1895

01:09:02,870 --> 01:09:01,120

quantum mechanical interpretations and

1896

01:09:06,309 --> 01:09:02,880

in some sense they're each right

1897

01:09:07,189 --> 01:09:06,319

now that phrase they're each right

1898

01:09:09,110 --> 01:09:07,199

that's

1899

01:09:10,789 --> 01:09:09,120

i'm not driven by promoting peace even

1900

01:09:11,990 --> 01:09:10,799

though it seems like i'm ironic it's

1901

01:09:14,149 --> 01:09:12,000

just that

1902

01:09:16,709 --> 01:09:14,159

look i i didn't say they're each right i

1903

01:09:17,829 --> 01:09:16,719

see i said they're each coherent and

1904

01:09:19,590 --> 01:09:17,839

possible

1905

01:09:22,789 --> 01:09:19,600

they're not wrong

1906

01:09:24,950 --> 01:09:22,799

let me explain so before copernicus

1907

01:09:27,269 --> 01:09:24,960

earth center copernicus no sun is

1908

01:09:30,149 --> 01:09:27,279

centered einstein hey you're both right

1909

01:09:31,910 --> 01:09:30,159

in some way now i'm curious as i

1910

01:09:33,110 --> 01:09:31,920

investigate more philosophy even

1911

01:09:34,630 --> 01:09:33,120

religion

1912

01:09:36,550 --> 01:09:34,640

just like there was this line in your

1913

01:09:38,470 --> 01:09:36,560

book about up and down and it seems to

1914

01:09:40,070 --> 01:09:38,480

make no sense it seems contradictory

1915

01:09:42,149 --> 01:09:40,080

until you view it from another point of

1916

01:09:44,390 --> 01:09:42,159

view and you see oh well what's up to

1917

01:09:45,749 --> 01:09:44,400

australians is down to us canadians and

1918

01:09:48,550 --> 01:09:45,759

so on

1919

01:09:51,590 --> 01:09:48,560

okay well i'm als i also see or also

1920

01:09:53,510 --> 01:09:51,600

wonder how much of religion and

1921

01:09:55,669 --> 01:09:53,520

well philosophy in general but let's

1922

01:09:57,350 --> 01:09:55,679

just take religion

1923

01:09:59,110 --> 01:09:57,360

it's it seems like

1924

01:10:01,270 --> 01:09:59,120

the major religions contradict with one

1925

01:10:02,870 --> 01:10:01,280

another but are they true contradictions

1926

01:10:04,709 --> 01:10:02,880

when viewed from another perspective is

1927

01:10:06,390 --> 01:10:04,719

there another one in which you can say

1928

01:10:07,990 --> 01:10:06,400

actually that's right in some way that's

1929

01:10:11,110 --> 01:10:08,000

right in some other way and that's right

1930

01:10:13,910 --> 01:10:11,120

no okay i've just outlined in a sense my

1931

01:10:16,390 --> 01:10:13,920

outlook my personality

1932

01:10:18,310 --> 01:10:16,400

do you view problems like that or do you

1933

01:10:19,350 --> 01:10:18,320

see what i said as having any truth or

1934

01:10:21,030 --> 01:10:19,360

is there something that i should be

1935

01:10:23,590 --> 01:10:21,040

aware of as a limitation in that

1936

01:10:28,870 --> 01:10:25,830

well it's it's uh

1937

01:10:30,870 --> 01:10:28,880

you bring different things together um

1938

01:10:33,270 --> 01:10:30,880

first of all uh

1939

01:10:34,870 --> 01:10:33,280

let me separate my answer in two parts

1940

01:10:36,790 --> 01:10:34,880

first of all uh

1941

01:10:40,470 --> 01:10:36,800

religion is a very complicated phenomena

1942

01:10:41,350 --> 01:10:40,480

very very very wide phenomenon

1943

01:10:43,590 --> 01:10:41,360

uh

1944

01:10:45,750 --> 01:10:43,600

you mentioned the big religion

1945

01:10:47,270 --> 01:10:45,760

religions big religions first of all

1946

01:10:49,430 --> 01:10:47,280

they're different from one another

1947

01:10:52,070 --> 01:10:49,440

they're different properties second they

1948

01:10:53,189 --> 01:10:52,080

are institutions their people their

1949

01:10:55,910 --> 01:10:53,199

history

1950

01:10:58,709 --> 01:10:55,920

their center of powers sometimes the

1951

01:11:00,870 --> 01:10:58,719

systems of beliefs they make statement

1952

01:11:02,950 --> 01:11:00,880

their moral systems

1953

01:11:05,030 --> 01:11:02,960

uh their ways for people for thinking

1954

01:11:06,470 --> 01:11:05,040

the world their way of people to getting

1955

01:11:08,229 --> 01:11:06,480

together you know you go to the church

1956

01:11:10,950 --> 01:11:08,239

and you fight friends

1957

01:11:12,149 --> 01:11:10,960

so um

1958

01:11:14,390 --> 01:11:12,159

it's uh

1959

01:11:16,550 --> 01:11:14,400

it makes no sense to say

1960

01:11:18,310 --> 01:11:16,560

uh it's certain religion right or wrong

1961

01:11:20,950 --> 01:11:18,320

i mean it's like saying is the united

1962

01:11:22,950 --> 01:11:20,960

states right or wrong well it's in my

1963

01:11:24,630 --> 01:11:22,960

opinion is wrong in some things like

1964

01:11:26,870 --> 01:11:24,640

some other thing

1965

01:11:29,590 --> 01:11:26,880

i disagree with some of his politics i

1966

01:11:32,390 --> 01:11:29,600

like some of its uh face ideology

1967

01:11:33,990 --> 01:11:32,400

whatever so um

1968

01:11:38,070 --> 01:11:34,000

so uh

1969

01:11:41,189 --> 01:11:38,080

if you isolate within religion

1970

01:11:43,750 --> 01:11:41,199

uh certain uh moral

1971

01:11:47,270 --> 01:11:43,760

aspect uh

1972

01:11:50,070 --> 01:11:47,280

definitely you you

1973

01:11:52,470 --> 01:11:50,080

i am not religious at all i'm an atheist

1974

01:11:54,870 --> 01:11:52,480

i feel perfectly sympathetic i mean i'm

1975

01:11:56,870 --> 01:11:54,880

happy to uh

1976

01:11:58,870 --> 01:11:56,880

fight together with some religious

1977

01:12:00,070 --> 01:11:58,880

people for the peace in the world i

1978

01:12:03,189 --> 01:12:00,080

don't know

1979

01:12:06,070 --> 01:12:03,199

um if you isolate some other aspects

1980

01:12:09,110 --> 01:12:06,080

uh like the belief that was a creator

1981

01:12:11,030 --> 01:12:09,120

which is a person i just find it wrong

1982

01:12:12,149 --> 01:12:11,040

i i think it's wrong

1983

01:12:15,270 --> 01:12:12,159

so

1984

01:12:17,990 --> 01:12:15,280

uh it's a very complicated story and i i

1985

01:12:20,310 --> 01:12:18,000

i see a lot of bad in religions i also

1986

01:12:21,669 --> 01:12:20,320

see a lot of good religions i i don't

1987

01:12:23,110 --> 01:12:21,679

want to enter in which one i think is

1988

01:12:23,990 --> 01:12:23,120

strong

1989

01:12:26,870 --> 01:12:24,000

um

1990

01:12:29,669 --> 01:12:26,880

now let me let me zoom into your your

1991

01:12:32,149 --> 01:12:29,679

point uh because you said well does this

1992

01:12:34,790 --> 01:12:32,159

mean that tamal

1993

01:12:40,790 --> 01:12:34,800

there is always some something right

1994

01:12:45,669 --> 01:12:43,350

it's more interesting namely

1995

01:12:48,950 --> 01:12:45,679

uh i think that we

1996

01:12:51,590 --> 01:12:48,960

we humans live in a dialogue

1997

01:12:53,510 --> 01:12:51,600

and the good of the dialogue

1998

01:12:55,510 --> 01:12:53,520

is that we change our mind because of

1999

01:12:58,070 --> 01:12:55,520

what we hear from the other guy right

2000

01:13:00,470 --> 01:12:58,080

that's how culture has developed that's

2001

01:13:03,110 --> 01:13:00,480

how science has developed

2002

01:13:05,270 --> 01:13:03,120

and each time so

2003

01:13:06,950 --> 01:13:05,280

we're always

2004

01:13:09,270 --> 01:13:06,960

the best thinking

2005

01:13:11,750 --> 01:13:09,280

it's always in search of what is wrong

2006

01:13:13,590 --> 01:13:11,760

not what is right okay what is wrong

2007

01:13:15,270 --> 01:13:13,600

with my thinking what is wrong in your

2008

01:13:17,110 --> 01:13:15,280

thinking because that's what allows us

2009

01:13:18,550 --> 01:13:17,120

to go ahead right

2010

01:13:20,149 --> 01:13:18,560

is

2011

01:13:27,030 --> 01:13:20,159

the

2012

01:13:27,830 --> 01:13:27,040

has not been you know to to to

2013

01:13:36,470 --> 01:13:27,840

to

2014

01:13:39,669 --> 01:13:36,480

center is wrong

2015

01:13:40,790 --> 01:13:39,679

just found something wrong in the

2016

01:13:42,709 --> 01:13:40,800

uh

2017

01:13:43,990 --> 01:13:42,719

in the basis

2018

01:13:45,350 --> 01:13:44,000

of

2019

01:13:47,990 --> 01:13:45,360

um

2020

01:13:49,669 --> 01:13:48,000

of the way astronomers thought for for

2021

01:13:52,310 --> 01:13:49,679

centuries and and you know a couple

2022

01:13:55,350 --> 01:13:52,320

generation later ketler

2023

01:13:57,350 --> 01:13:55,360

did the same game he discovered that for

2024

01:13:59,030 --> 01:13:57,360

two millennia people try to make sense

2025

01:14:01,590 --> 01:13:59,040

of what we see in the sky in terms of

2026

01:14:03,750 --> 01:14:01,600

circles and he says this is not circles

2027

01:14:05,430 --> 01:14:03,760

they're ellipses okay so after two

2028

01:14:07,030 --> 01:14:05,440

millennia of circles he said well forget

2029

01:14:09,430 --> 01:14:07,040

circles

2030

01:14:10,470 --> 01:14:09,440

so what is interesting what we are wrong

2031

01:14:12,550 --> 01:14:10,480

okay

2032

01:14:15,189 --> 01:14:12,560

and i think there are a lot of wrong

2033

01:14:17,910 --> 01:14:15,199

ideas in instead of all

2034

01:14:19,430 --> 01:14:17,920

inside a lot of beautiful

2035

01:14:21,990 --> 01:14:19,440

moral social

2036

01:14:24,790 --> 01:14:22,000

human constructions and behaviors there

2037

01:14:25,590 --> 01:14:24,800

are just wrong ideas in many religions

2038

01:14:26,950 --> 01:14:25,600

um

2039

01:14:28,390 --> 01:14:26,960

it has to be so because they are so

2040

01:14:29,750 --> 01:14:28,400

contradictory of one another of course

2041

01:14:31,510 --> 01:14:29,760

there's some wrong ideas i mean they

2042

01:14:33,430 --> 01:14:31,520

cannot be all right

2043

01:14:35,669 --> 01:14:33,440

so the fact that we can learn from one

2044

01:14:38,550 --> 01:14:35,679

another and

2045

01:14:40,830 --> 01:14:38,560

we can often um

2046

01:14:42,630 --> 01:14:40,840

take a larger point of view

2047

01:14:45,270 --> 01:14:42,640

on

2048

01:14:47,990 --> 01:14:45,280

does not change the fact that there's a

2049

01:14:49,990 --> 01:14:48,000

precise sense in which uh

2050

01:14:52,390 --> 01:14:50,000

the pre-copernicus system the ptolemaic

2051
01:14:54,470 --> 01:14:52,400
system is just wrong factually wrong and

2052
01:14:55,189 --> 01:14:54,480
copernicus system is wrong

2053
01:14:57,910 --> 01:14:55,199
and

2054
01:14:59,750 --> 01:14:57,920
kepler is wrong because

2055
01:15:01,510 --> 01:14:59,760
planets don't go along ellipses they

2056
01:15:03,430 --> 01:15:01,520
move more complicated and newton's

2057
01:15:04,950 --> 01:15:03,440
theory is wrong because if you take

2058
01:15:06,310 --> 01:15:04,960
newton's theory

2059
01:15:08,470 --> 01:15:06,320
and you

2060
01:15:10,709 --> 01:15:08,480
use neutral theory to compute the motion

2061
01:15:12,709 --> 01:15:10,719
of mercury just get it wrong

2062
01:15:14,709 --> 01:15:12,719
okay you miss a little correction which

2063
01:15:16,070 --> 01:15:14,719

comes correct with generativity

2064

01:15:17,270 --> 01:15:16,080

so

2065

01:15:18,310 --> 01:15:17,280

um

2066

01:15:19,910 --> 01:15:18,320

in a sense

2067

01:15:22,310 --> 01:15:19,920

uh

2068

01:15:25,350 --> 01:15:23,350

i'm not

2069

01:15:26,790 --> 01:15:25,360

i think there is to learn from from

2070

01:15:27,990 --> 01:15:26,800

different things i think it's good to

2071

01:15:30,070 --> 01:15:28,000

give

2072

01:15:31,590 --> 01:15:30,080

keep an open mind and to listen

2073

01:15:33,669 --> 01:15:31,600

different perspective

2074

01:15:35,590 --> 01:15:33,679

but the interesting of the dialogue is

2075

01:15:38,470 --> 01:15:35,600

precisely when we can

2076

01:15:41,590 --> 01:15:38,480

step out from mistakes in one one one

2077

01:15:45,430 --> 01:15:43,590

see for me when it comes to religion in

2078

01:15:47,590 --> 01:15:45,440

particular i would say up until just a

2079

01:15:49,430 --> 01:15:47,600

couple years ago i was such an adamant

2080

01:15:51,430 --> 01:15:49,440

atheist and i wouldn't say that i'm a

2081

01:15:53,510 --> 01:15:51,440

theist now at all i'm i just wouldn't

2082

01:15:56,630 --> 01:15:53,520

classify myself as either being pro or

2083

01:15:58,870 --> 01:15:56,640

against but say i'm undecided the reason

2084

01:16:01,830 --> 01:15:58,880

why i don't focus on the wrong

2085

01:16:03,510 --> 01:16:01,840

is because to people like me and and you

2086

01:16:06,070 --> 01:16:03,520

scientifically minded people it's fairly

2087

01:16:07,350 --> 01:16:06,080

obvious the wrong it's just so blatant i

2088

01:16:09,750 --> 01:16:07,360

find it much more interesting and

2089

01:16:11,430 --> 01:16:09,760

difficult to see well what is compatible

2090

01:16:14,070 --> 01:16:11,440

and what is correct from another point

2091

01:16:15,830 --> 01:16:14,080

of view may also that

2092

01:16:18,870 --> 01:16:15,840

definitely knowing where one is wrong

2093

01:16:20,310 --> 01:16:18,880

even the nuances of incorrectness adds

2094

01:16:22,149 --> 01:16:20,320

to certain correctness like gives you

2095

01:16:23,350 --> 01:16:22,159

different points of view so let's i

2096

01:16:25,430 --> 01:16:23,360

understand that

2097

01:16:28,229 --> 01:16:25,440

you know speaking of what's wrong i'm

2098

01:16:31,830 --> 01:16:28,239

curious let's imagine if

2099

01:16:34,310 --> 01:16:31,840

all properties are relative okay now is

2100

01:16:36,870 --> 01:16:34,320

the law that all properties are relative

2101
01:16:38,790 --> 01:16:36,880
a property can you be relational with

2102
01:16:40,950 --> 01:16:38,800
respect to the principle of relation

2103
01:16:42,390 --> 01:16:40,960
what does that even mean does that lie

2104
01:16:43,590 --> 01:16:42,400
outside

2105
01:16:45,830 --> 01:16:43,600
do you understand what i'm saying i know

2106
01:16:47,030 --> 01:16:45,840
this is extremely ill-defined

2107
01:16:48,310 --> 01:16:47,040
but i'm always interested in what

2108
01:16:49,350 --> 01:16:48,320
happens when a principle is applied to

2109
01:16:51,830 --> 01:16:49,360
itself

2110
01:16:53,030 --> 01:16:51,840
so even let's say bayesian reasoning

2111
01:16:55,350 --> 01:16:53,040
if you ask someone who says i'm a

2112
01:16:57,270 --> 01:16:55,360
bayesian reasoner okay so do you believe

2113
01:16:59,990 --> 01:16:57,280

anything with 100 certainty they may say

2114

01:17:01,590 --> 01:17:00,000

no like i'm a scientist so i okay do you

2115

01:17:03,350 --> 01:17:01,600

doubt the principle of

2116

01:17:04,790 --> 01:17:03,360

bayesian reasoning even one even a

2117

01:17:06,790 --> 01:17:04,800

little even a tiny because as soon as

2118

01:17:08,229 --> 01:17:06,800

you open a sliver there then what

2119

01:17:09,430 --> 01:17:08,239

happens when you

2120

01:17:17,750 --> 01:17:09,440

well

2121

01:17:19,510 --> 01:17:17,760

saying um

2122

01:17:22,630 --> 01:17:19,520

i think that one of the

2123

01:17:26,470 --> 01:17:22,640

interesting trends in contemporary

2124

01:17:32,790 --> 01:17:27,750

it's

2125

01:17:34,630 --> 01:17:33,669

uh

2126
01:17:36,910 --> 01:17:34,640
it's not

2127
01:17:40,709 --> 01:17:36,920
a new idea there was

2128
01:17:41,590 --> 01:17:40,719
anti-foundationalism in um

2129
01:17:43,669 --> 01:17:41,600
thinking

2130
01:17:46,550 --> 01:17:43,679
in in western and also in eastern

2131
01:17:48,310 --> 01:17:46,560
philosophy um

2132
01:17:52,149 --> 01:17:48,320
and this is idea that what does that

2133
01:17:55,750 --> 01:17:52,159
mean yeah it's idea that you uh

2134
01:17:56,830 --> 01:17:55,760
you don't need to hold

2135
01:18:00,229 --> 01:17:56,840
to

2136
01:18:02,550 --> 01:18:00,239
um uh

2137
01:18:03,430 --> 01:18:02,560
not only to absolute certainty but to

2138
01:18:09,590 --> 01:18:03,440

any

2139

01:18:11,830 --> 01:18:09,600

is is sort of is a shift is idea of

2140

01:18:14,149 --> 01:18:11,840

shifting

2141

01:18:16,070 --> 01:18:14,159

from what we can say for sure what can

2142

01:18:18,390 --> 01:18:16,080

you say from final

2143

01:18:20,790 --> 01:18:18,400

to uh what we can say

2144

01:18:24,310 --> 01:18:20,800

um

2145

01:18:25,430 --> 01:18:24,320

interesting and and and valuable

2146

01:18:27,110 --> 01:18:25,440

um

2147

01:18:30,950 --> 01:18:27,120

in fact this is

2148

01:18:32,630 --> 01:18:30,960

look uh kurt your your um

2149

01:18:34,229 --> 01:18:32,640

your series is about the theory of

2150

01:18:35,510 --> 01:18:34,239

everything

2151

01:18:36,630 --> 01:18:35,520

i don't think we need a theory of

2152

01:18:39,030 --> 01:18:36,640

everything

2153

01:18:41,830 --> 01:18:39,040

i i think we need good theories

2154

01:18:43,750 --> 01:18:41,840

the more coherent possible the more

2155

01:18:45,189 --> 01:18:43,760

uh useful possible more advanced

2156

01:18:49,430 --> 01:18:45,199

possible

2157

01:18:53,510 --> 01:18:50,950

as soon as someone says yes i think of

2158

01:18:56,470 --> 01:18:53,520

pragmatism like it's all a goal based

2159

01:18:58,550 --> 01:18:56,480

whether it's adaptive uh

2160

01:19:00,870 --> 01:18:58,560

well maybe it's pragmatic i don't know

2161

01:19:02,630 --> 01:19:00,880

it's a

2162

01:19:05,270 --> 01:19:02,640

pragmatism

2163

01:19:07,510 --> 01:19:05,280

philosophical current has as much more

2164

01:19:08,630 --> 01:19:07,520

um

2165

01:19:17,110 --> 01:19:08,640

i

2166

01:19:18,709 --> 01:19:17,120

uh

2167

01:19:20,550 --> 01:19:18,719

this attitude

2168

01:19:22,310 --> 01:19:20,560

which is look we can learn it's it's

2169

01:19:24,390 --> 01:19:22,320

historically we know what we can learn

2170

01:19:27,910 --> 01:19:24,400

we can learn more and more and more but

2171

01:19:30,149 --> 01:19:27,920

it's not useful it's useful to ask

2172

01:19:33,510 --> 01:19:30,159

as best as we know today what is the

2173

01:19:35,350 --> 01:19:33,520

best organization we have of our of of

2174

01:19:37,669 --> 01:19:35,360

of the world and it's true that there's

2175

01:19:39,590 --> 01:19:37,679

a remarkable coherence in our culture

2176

01:19:43,110 --> 01:19:39,600

and our understanding of the world

2177

01:19:45,510 --> 01:19:43,120

but asking what is the final

2178

01:19:47,669 --> 01:19:45,520

uh ingredient of the world what is the

2179

01:19:49,430 --> 01:19:47,679

final rules of thinking

2180

01:19:51,510 --> 01:19:49,440

what is the basic substance of

2181

01:19:53,030 --> 01:19:51,520

everything it's just a bad it's a

2182

01:19:55,910 --> 01:19:53,040

useless question

2183

01:19:58,550 --> 01:19:55,920

that's my take

2184

01:20:01,430 --> 01:19:58,560

so can we live with uncertainty yes do

2185

01:20:02,470 --> 01:20:01,440

we have to take something as

2186

01:20:05,110 --> 01:20:02,480

uh

2187

01:20:06,149 --> 01:20:05,120

can we doubt our also our doubt sure we

2188

01:20:10,229 --> 01:20:06,159

can

2189

01:20:15,270 --> 01:20:12,950

i will read from your book to give

2190

01:20:17,189 --> 01:20:15,280

people an overview and by the way write

2191

01:20:18,870 --> 01:20:17,199

previous to this question i just wrote

2192

01:20:21,590 --> 01:20:18,880

down a wonderfully

2193

01:20:24,070 --> 01:20:21,600

philosophical set of sentences from you

2194

01:20:25,830 --> 01:20:24,080

which was about bryce and john

2195

01:20:27,590 --> 01:20:25,840

when you met them and then you felt the

2196

01:20:29,590 --> 01:20:27,600

pain of their absence you then wrote but

2197

01:20:31,669 --> 01:20:29,600

it isn't the absence that causes sorrow

2198

01:20:33,910 --> 01:20:31,679

it is affection and love without

2199

01:20:36,709 --> 01:20:33,920

affection without love such absences

2200

01:20:39,669 --> 01:20:36,719

would cause us no pain for this reason

2201

01:20:42,390 --> 01:20:39,679

even the pain caused by absence is in

2202

01:20:43,990 --> 01:20:42,400

the end something good and beautiful

2203

01:20:45,510 --> 01:20:44,000

because it feeds on that which gives

2204

01:20:47,350 --> 01:20:45,520

meaning to life

2205

01:20:48,550 --> 01:20:47,360

if those of you who are watching are

2206

01:20:49,990 --> 01:20:48,560

listening

2207

01:20:51,430 --> 01:20:50,000

i've recommended only one book

2208

01:20:53,990 --> 01:20:51,440

consistently and that's ian mcgill

2209

01:20:55,430 --> 01:20:54,000

christ's master and his emissary and i'm

2210

01:20:57,510 --> 01:20:55,440

going to start to add a second one and

2211

01:20:59,350 --> 01:20:57,520

that's order of time

2212

01:21:01,189 --> 01:20:59,360

it's filled with firstly if you want to

2213

01:21:03,510 --> 01:21:01,199

know about the nature of time and how

2214

01:21:04,870 --> 01:21:03,520

time has been thought of and redefined

2215

01:21:06,310 --> 01:21:04,880

or not well

2216

01:21:09,430 --> 01:21:06,320

recontextualized is a better way of

2217

01:21:11,189 --> 01:21:09,440

thinking about it it's

2218

01:21:13,189 --> 01:21:11,199

it's a wonderful wonderful book and it's

2219

01:21:14,950 --> 01:21:13,199

quite short so the opposite is ian

2220

01:21:17,510 --> 01:21:14,960

mcgill chris which is i think

2221

01:21:18,870 --> 01:21:17,520

a tome and then yours is a compendium

2222

01:21:20,709 --> 01:21:18,880

it's quite

2223

01:21:22,310 --> 01:21:20,719

digestible

2224

01:21:23,510 --> 01:21:22,320

okay let's get to thermal time so

2225

01:21:25,110 --> 01:21:23,520

firstly i want to

2226

01:21:28,149 --> 01:21:25,120

tell you how beautiful

2227

01:21:29,830 --> 01:21:28,159

that set of lines were

2228

01:21:31,830 --> 01:21:29,840

thank you very much good thank you for

2229

01:21:35,030 --> 01:21:31,840

saying that about uh the audio of time

2230

01:21:36,709 --> 01:21:35,040

is it's definitely the book which is uh

2231

01:21:38,550 --> 01:21:36,719

that i've written which is more close to

2232

01:21:41,110 --> 01:21:38,560

my to my heart because uh

2233

01:21:43,669 --> 01:21:41,120

it's a book and you know the quotation

2234

01:21:45,350 --> 01:21:43,679

you you mentioned uh uh

2235

01:21:46,870 --> 01:21:45,360

shows it um

2236

01:21:48,310 --> 01:21:46,880

it's a book in which i talk about

2237

01:21:55,510 --> 01:21:48,320

science

2238

01:21:57,590 --> 01:21:55,520

and uh and i i sort of try to summarize

2239

01:21:58,550 --> 01:21:57,600

everything we know from science about

2240

01:22:01,830 --> 01:21:58,560

time

2241

01:22:04,950 --> 01:22:01,840

and also the things we don't know uh

2242

01:22:06,709 --> 01:22:04,960

about time from from from science so i

2243

01:22:09,669 --> 01:22:06,719

it's a big part in which i just

2244

01:22:10,870 --> 01:22:09,679

explained at best as i understand

2245

01:22:12,390 --> 01:22:10,880

what we've learned about time for

2246

01:22:14,149 --> 01:22:12,400

special activity from statistical

2247

01:22:16,390 --> 01:22:14,159

mechanics from boltzmann et cetera et

2248

01:22:17,910 --> 01:22:16,400

cetera for quantum gravity

2249

01:22:19,510 --> 01:22:17,920

um

2250

01:22:21,270 --> 01:22:19,520

and then also

2251

01:22:24,390 --> 01:22:21,280

the open questions

2252

01:22:26,070 --> 01:22:24,400

what we think the speculations

2253

01:22:27,430 --> 01:22:26,080

but it's also a book

2254

01:22:29,189 --> 01:22:27,440

when i wrote it

2255

01:22:31,669 --> 01:22:29,199

time touches us right

2256

01:22:32,790 --> 01:22:31,679

we are time is not a neutral thing for

2257

01:22:35,189 --> 01:22:32,800

us because

2258

01:22:37,350 --> 01:22:35,199

it's what makes us living but also what

2259

01:22:39,910 --> 01:22:37,360

we lose time is losing

2260

01:22:42,310 --> 01:22:39,920

so time is something that touches deep

2261

01:22:44,790 --> 01:22:42,320

us inside so it's it's a book that while

2262

01:22:47,990 --> 01:22:44,800

writing it i had constantly this

2263

01:22:50,950 --> 01:22:48,000

emotional aspect about time in mind so

2264

01:22:53,590 --> 01:22:50,960

there's a lot of poetry in the

2265

01:22:55,110 --> 01:22:53,600

versus from horus which is an ancient

2266

01:22:57,750 --> 01:22:55,120

latin philosopher which i love which

2267

01:22:59,669 --> 01:22:57,760

talks about time the time that passes

2268

01:23:00,950 --> 01:22:59,679

the passage of time and there's the last

2269

01:23:03,030 --> 01:23:00,960

chapter in which i talk about death

2270

01:23:05,590 --> 01:23:03,040

which is the ultimate confrontation with

2271

01:23:09,510 --> 01:23:05,600

time that we have in our in our uh in

2272

01:23:11,590 --> 01:23:09,520

our life so it's a it's a book which is

2273

01:23:14,070 --> 01:23:11,600

science but also

2274

01:23:16,550 --> 01:23:14,080

uh our emotional relation with time as

2275

01:23:18,709 --> 01:23:16,560

you um

2276

01:23:21,189 --> 01:23:18,719

since the quotation you mentioned about

2277

01:23:23,350 --> 01:23:21,199

about pain and sore of losing people

2278

01:23:24,950 --> 01:23:23,360

all right so sorry for this that's right

2279

01:23:27,189 --> 01:23:24,960

in chapter 10.

2280

01:23:29,189 --> 01:23:27,199

i think in chapter 10 it's called

2281

01:23:31,350 --> 01:23:29,199

mandolin i don't recall the words that

2282

01:23:34,870 --> 01:23:31,360

came prior to it but it's about the

2283

01:23:36,470 --> 01:23:34,880

eastern mystic from the 100 years 100

2284

01:23:38,790 --> 01:23:36,480

first century sorry second century

2285

01:23:40,950 --> 01:23:38,800

nagarjuna is that correct

2286

01:23:42,310 --> 01:23:40,960

yeah nagarjuna is a chapter well no

2287

01:23:44,229 --> 01:23:42,320

there is a chapter in the guardian in

2288

01:23:46,149 --> 01:23:44,239

helgeland my book on quantum mechanics

2289

01:23:48,790 --> 01:23:46,159

okay so what was being referred to in

2290

01:23:51,270 --> 01:23:48,800

mandolin when oh this person said that

2291

01:23:53,669 --> 01:23:51,280

there is no i

2292

01:23:55,830 --> 01:23:53,679

oh yes yes yes yes that's a famous

2293

01:23:57,830 --> 01:23:55,840

dialect in eastern literature the

2294

01:24:00,390 --> 01:23:57,840

beginning of the buddhist

2295

01:24:04,550 --> 01:24:00,400

philosophy it's a spectacular dialogue

2296

01:24:07,110 --> 01:24:04,560

the dialogue about the chariot right

2297

01:24:09,430 --> 01:24:07,120

who is he speaking to

2298

01:24:12,709 --> 01:24:09,440

uh it's a king king oh i've got the name

2299

01:24:17,270 --> 01:24:14,870

it's it's a it's a it's it's one of the

2300

01:24:19,830 --> 01:24:17,280

topics you want to just discuss the

2301

01:24:21,750 --> 01:24:19,840

nature of i itself

2302

01:24:23,350 --> 01:24:21,760

um but let's go let's keep that for

2303

01:24:25,270 --> 01:24:23,360

later

2304

01:24:26,629 --> 01:24:25,280

so you asked about terminal time yeah

2305

01:24:28,950 --> 01:24:26,639

okay for the people who are listening

2306

01:24:30,790 --> 01:24:28,960

the links to carlo rivelli's book order

2307

01:24:32,550 --> 01:24:30,800

of time as well as his latest book are

2308

01:24:34,149 --> 01:24:32,560

in the description

2309

01:24:36,550 --> 01:24:34,159

and well what was super interesting to

2310

01:24:38,070 --> 01:24:36,560

me is in 2022 i'll start to delve a bit

2311

01:24:40,390 --> 01:24:38,080

more into eastern philosophies i've had

2312

01:24:42,149 --> 01:24:40,400

on pretty much zero although most

2313

01:24:43,270 --> 01:24:42,159

people's philosophies are influenced by

2314

01:24:44,390 --> 01:24:43,280

different parts of the world to some

2315

01:24:47,430 --> 01:24:44,400

degree

2316

01:24:49,590 --> 01:24:47,440

so this it was fun because when i was

2317

01:24:51,430 --> 01:24:49,600

first asking you for an interview

2318

01:24:53,350 --> 01:24:51,440

i used it as an opportunity for me to

2319

01:24:54,629 --> 01:24:53,360

learn loop quantum gravity

2320

01:24:55,750 --> 01:24:54,639

because i've always wanted to learn some

2321

01:24:56,709 --> 01:24:55,760

of that so i started going through your

2322

01:25:00,310 --> 01:24:56,719

lectures

2323

01:25:03,270 --> 01:25:00,320

but then i was sidetracked in the most

2324

01:25:04,790 --> 01:25:03,280

positive manner by order of time i just

2325

01:25:07,350 --> 01:25:04,800

i just i didn't think that you were such

2326

01:25:10,390 --> 01:25:07,360

a philosophical person and i thought boy

2327

01:25:12,629 --> 01:25:10,400

oh boy i don't

2328

01:25:13,830 --> 01:25:12,639

well i don't know of anyone who

2329

01:25:20,550 --> 01:25:13,840

is

2330

01:25:22,310 --> 01:25:20,560

cognitively flexible in that regard you

2331

01:25:24,470 --> 01:25:22,320

mentioned max tag mark but i haven't

2332

01:25:27,110 --> 01:25:24,480

looked him up much so i was just

2333

01:25:30,070 --> 01:25:27,120

i was thrown by that and i was i'm still

2334

01:25:31,270 --> 01:25:30,080

super excited to be speaking with you

2335

01:25:33,590 --> 01:25:31,280

thank you kurt

2336

01:25:35,110 --> 01:25:33,600

um thanks a lot um

2337

01:25:36,950 --> 01:25:35,120

so you want to know about terminal time

2338

01:25:39,270 --> 01:25:36,960

so can you explain what thermal time is

2339

01:25:40,950 --> 01:25:39,280

this is my question and then i head up

2340

01:25:43,910 --> 01:25:40,960

as a note so the conventional logic for

2341

01:25:45,430 --> 01:25:43,920

interpreting this relation is time

2342

01:25:47,990 --> 01:25:45,440

gives you a notion of energy which gives

2343

01:25:49,110 --> 01:25:48,000

you a notion of an a macroscopic state

2344

01:25:50,149 --> 01:25:49,120

now you're saying that this can be

2345

01:25:51,990 --> 01:25:50,159

reversed

2346

01:25:53,990 --> 01:25:52,000

okay now that's so using that as a

2347

01:25:55,510 --> 01:25:54,000

jumping off point and remember that the

2348

01:25:57,189 --> 01:25:55,520

audience understands what entropy and so

2349

01:25:58,470 --> 01:25:57,199

on is

2350

01:26:00,870 --> 01:25:58,480

though if you want to quickly go over

2351

01:26:04,550 --> 01:26:00,880

you're more than welcome to

2352

01:26:12,950 --> 01:26:07,750

um

2353

01:26:13,990 --> 01:26:12,960

uh in understanding time

2354

01:26:15,430 --> 01:26:14,000

i think there are a lot of things we

2355

01:26:16,870 --> 01:26:15,440

have understood

2356

01:26:18,390 --> 01:26:16,880

that time doesn't work for the way we

2357

01:26:20,070 --> 01:26:18,400

usually think about because we have

2358

01:26:22,070 --> 01:26:20,080

understood this with special relativity

2359

01:26:23,510 --> 01:26:22,080

general activity with statistical

2360

01:26:25,350 --> 01:26:23,520

mechanics but then there are some open

2361

01:26:26,390 --> 01:26:25,360

questions

2362

01:26:28,070 --> 01:26:26,400

and

2363

01:26:29,510 --> 01:26:28,080

among the

2364

01:26:31,910 --> 01:26:29,520

open questions

2365

01:26:33,669 --> 01:26:31,920

it's following

2366

01:26:34,629 --> 01:26:33,679

once we go

2367

01:26:37,030 --> 01:26:34,639

to

2368

01:26:38,950 --> 01:26:37,040

a generality relativistic description

2369

01:26:40,629 --> 01:26:38,960

about the world

2370

01:26:42,229 --> 01:26:40,639

um

2371

01:26:44,310 --> 01:26:42,239

the so

2372

01:26:46,550 --> 01:26:44,320

description of the world

2373

01:26:48,390 --> 01:26:46,560

large enough to include the relativistic

2374

01:26:50,629 --> 01:26:48,400

properties of gravity

2375

01:26:53,350 --> 01:26:50,639

then the theory we use

2376

01:26:55,110 --> 01:26:53,360
does not have a lot of variables

2377

01:26:56,790 --> 01:26:55,120
variable things we measure

2378

01:26:58,709 --> 01:26:56,800
but none of this

2379

01:27:00,229 --> 01:26:58,719
is naturally identified as a time

2380

01:27:01,669 --> 01:27:00,239
variable

2381

01:27:03,270 --> 01:27:01,679
that's the point

2382

01:27:05,030 --> 01:27:03,280
and i'm not talking

2383

01:27:07,350 --> 01:27:05,040
for those who are

2384

01:27:09,669 --> 01:27:07,360
more learned among those who

2385

01:27:12,870 --> 01:27:09,679
you guys who listen i'm not talking

2386

01:27:15,030 --> 01:27:12,880
about in a given space time

2387

01:27:16,950 --> 01:27:15,040
which one is a time of course in a given

2388

01:27:18,709 --> 01:27:16,960

space time there's the clocks that

2389

01:27:20,070 --> 01:27:18,719

measure proper time along each line we

2390

01:27:21,830 --> 01:27:20,080

know this time

2391

01:27:24,070 --> 01:27:21,840

but i'm talking about the

2392

01:27:25,669 --> 01:27:24,080

evolution of space-time itself i mean

2393

01:27:28,470 --> 01:27:25,679

the einstein equation

2394

01:27:30,229 --> 01:27:28,480

that evolved for gravity space-time

2395

01:27:32,950 --> 01:27:30,239

matter everything

2396

01:27:35,510 --> 01:27:32,960

in that evolution this evolution is

2397

01:27:39,110 --> 01:27:35,520

given as relative evolution of variables

2398

01:27:40,070 --> 01:27:39,120

and not evolution in time

2399

01:27:42,470 --> 01:27:40,080

uh

2400

01:27:43,669 --> 01:27:42,480

and then case by case we can identify

2401

01:27:46,229 --> 01:27:43,679

say well let's

2402

01:27:48,709 --> 01:27:46,239

call this time

2403

01:27:51,910 --> 01:27:48,719

one one particular variable this works

2404

01:27:55,110 --> 01:27:51,920

um in fact this is the way the world is

2405

01:27:56,870 --> 01:27:55,120

at the level of of of generativity

2406

01:27:59,270 --> 01:27:56,880

and also at the level of a general

2407

01:28:00,870 --> 01:27:59,280

relativistic quantum field for quantum

2408

01:28:02,310 --> 01:28:00,880

gravity but then there is something

2409

01:28:04,390 --> 01:28:02,320

funny

2410

01:28:07,910 --> 01:28:04,400

and that's a question

2411

01:28:10,709 --> 01:28:07,920

in our experience it's very clear

2412

01:28:13,510 --> 01:28:10,719

uh which variable is time it's it's the

2413

01:28:15,750 --> 01:28:13,520

one that clocks are connected to okay

2414

01:28:17,830 --> 01:28:15,760

the time value is completely different

2415

01:28:20,229 --> 01:28:17,840

than the other variables

2416

01:28:21,430 --> 01:28:20,239

profoundly different

2417

01:28:22,390 --> 01:28:21,440

and

2418

01:28:25,110 --> 01:28:22,400

so

2419

01:28:27,590 --> 01:28:25,120

how is it possible that from a theory in

2420

01:28:28,790 --> 01:28:27,600

which no specific variable is temporal

2421

01:28:30,149 --> 01:28:28,800

then

2422

01:28:31,189 --> 01:28:30,159

for us

2423

01:28:32,790 --> 01:28:31,199

uh

2424

01:28:33,910 --> 01:28:32,800

one variable which is the position of

2425

01:28:35,189 --> 01:28:33,920

the clock is definitely completely

2426

01:28:36,950 --> 01:28:35,199

different than the others because it

2427

01:28:38,550 --> 01:28:36,960

distinguishes pass from the future in

2428

01:28:39,750 --> 01:28:38,560

such a way

2429

01:28:41,510 --> 01:28:39,760

so i

2430

01:28:44,149 --> 01:28:41,520

worked on that

2431

01:28:46,470 --> 01:28:44,159

and i wrote some papers several papers

2432

01:28:49,350 --> 01:28:46,480

from that and a key paper with a french

2433

01:28:51,030 --> 01:28:49,360

mathematician field medal alain khon a

2434

01:28:52,950 --> 01:28:51,040

spectacular and brilliant and good

2435

01:28:55,030 --> 01:28:52,960

mathematician

2436

01:28:58,149 --> 01:28:55,040

because we got to this idea

2437

01:29:00,149 --> 01:28:58,159

both of us uh independently in a very

2438

01:29:01,350 --> 01:29:00,159

different path and we wrote this paper

2439

01:29:03,669 --> 01:29:01,360

together

2440

01:29:06,310 --> 01:29:03,679

he came to that from pure mathematics i

2441

01:29:08,470 --> 01:29:06,320

came that from think about physics

2442

01:29:10,550 --> 01:29:08,480

and so the idea is a speculative idea

2443

01:29:13,350 --> 01:29:10,560

i'm not sure is correct uh it's not

2444

01:29:15,830 --> 01:29:13,360

something people agree upon but i i put

2445

01:29:17,750 --> 01:29:15,840

in the book as a as a speculation it's

2446

01:29:19,110 --> 01:29:17,760

something i i think in some sense should

2447

01:29:21,590 --> 01:29:19,120

be right

2448

01:29:23,110 --> 01:29:21,600

um and there is a following

2449

01:29:24,950 --> 01:29:23,120

that

2450

01:29:26,310 --> 01:29:24,960

when we distinguish the time variable

2451
01:29:27,750 --> 01:29:26,320
from the other

2452
01:29:29,990 --> 01:29:27,760
it's because

2453
01:29:31,430 --> 01:29:30,000
of of what peculiar time what is

2454
01:29:33,750 --> 01:29:31,440
peculiar of time that the past is so

2455
01:29:35,830 --> 01:29:33,760
different from the future okay the

2456
01:29:37,350 --> 01:29:35,840
right and left are not different up and

2457
01:29:39,430 --> 01:29:37,360
down are not so different a little bit

2458
01:29:40,870 --> 01:29:39,440
different but we understand that

2459
01:29:42,229 --> 01:29:40,880
uh passive future are completely

2460
01:29:42,950 --> 01:29:42,239
different

2461
01:29:45,189 --> 01:29:42,960
and

2462
01:29:46,790 --> 01:29:45,199
but the big difference the the many

2463
01:29:49,750 --> 01:29:46,800

differences which we can write down but

2464

01:29:51,030 --> 01:29:49,760

the big difference is that entropy grows

2465

01:29:53,910 --> 01:29:51,040

toward the

2466

01:29:55,750 --> 01:29:53,920

future okay and this is a reason

2467

01:29:58,149 --> 01:29:55,760

we remember the past not the future

2468

01:30:00,550 --> 01:29:58,159

this is the reason the future feels open

2469

01:30:03,189 --> 01:30:00,560

this is a reason uh uh

2470

01:30:04,709 --> 01:30:03,199

uh if you if you if you sure feel

2471

01:30:07,189 --> 01:30:04,719

backward the moving backward is

2472

01:30:08,070 --> 01:30:07,199

obviously backwards and so on so forth

2473

01:30:10,629 --> 01:30:08,080

so

2474

01:30:12,390 --> 01:30:10,639

what characterize a time direction is

2475

01:30:15,030 --> 01:30:12,400

not mechanics

2476
01:30:18,390 --> 01:30:15,040
is entropy and entropy means statistical

2477
01:30:20,629 --> 01:30:18,400
mechanics and means

2478
01:30:22,629 --> 01:30:20,639
that we're giving a close grain

2479
01:30:24,790 --> 01:30:22,639
description of the world in terms of

2480
01:30:26,950 --> 01:30:24,800
temperature entropy so we have many

2481
01:30:27,910 --> 01:30:26,960
degrees of freedom and we are

2482
01:30:30,790 --> 01:30:27,920
um

2483
01:30:35,750 --> 01:30:30,800
uh

2484
01:30:38,629 --> 01:30:35,760
few of them this is what entropy is

2485
01:30:40,550 --> 01:30:38,639
about so there's something about the

2486
01:30:43,669 --> 01:30:40,560
flow of time which has to do with the

2487
01:30:48,229 --> 01:30:45,669
we don't describe the microphysics we

2488
01:30:50,470 --> 01:30:48,239

have this macroscopic description now if

2489

01:30:52,390 --> 01:30:50,480

it is so

2490

01:30:54,310 --> 01:30:52,400

then

2491

01:30:55,110 --> 01:30:54,320

it's very tempting

2492

01:30:59,830 --> 01:30:55,120

to

2493

01:31:00,870 --> 01:30:59,840

between the flow of time

2494

01:31:03,590 --> 01:31:00,880

and

2495

01:31:05,270 --> 01:31:03,600

the macro physics okay in in the

2496

01:31:06,629 --> 01:31:05,280

following sense

2497

01:31:09,669 --> 01:31:06,639

uh

2498

01:31:12,390 --> 01:31:09,679

we learn in in physics textbook that the

2499

01:31:14,629 --> 01:31:12,400

time passes okay systems automatically

2500

01:31:16,070 --> 01:31:14,639

equilibrate because of the second law of

2501

01:31:17,350 --> 01:31:16,080

thermodynamics so they go toward

2502

01:31:18,709 --> 01:31:17,360

equilibrium

2503

01:31:20,950 --> 01:31:18,719

and when they go where they go to

2504

01:31:22,629 --> 01:31:20,960

equilibrium they go to a state which is

2505

01:31:24,950 --> 01:31:22,639

an equilibrium state and this

2506

01:31:26,790 --> 01:31:24,960

equilibrium state

2507

01:31:29,669 --> 01:31:26,800

is described

2508

01:31:31,510 --> 01:31:29,679

in the physics as one particular state

2509

01:31:33,510 --> 01:31:31,520

in the sense of

2510

01:31:34,870 --> 01:31:33,520

statistical mechanics a probability

2511

01:31:36,470 --> 01:31:34,880

distribution of all possible

2512

01:31:38,310 --> 01:31:36,480

configurations

2513

01:31:41,030 --> 01:31:38,320

okay

2514

01:31:42,310 --> 01:31:41,040

so the logic think of the logic time

2515

01:31:45,990 --> 01:31:42,320

passes

2516

01:31:48,149 --> 01:31:46,000

and this determines a particular state

2517

01:31:49,590 --> 01:31:48,159

now the idea

2518

01:31:50,550 --> 01:31:49,600

alain and i

2519

01:31:52,629 --> 01:31:50,560

uh

2520

01:31:55,750 --> 01:31:52,639

got independently is that maybe this is

2521

01:31:59,270 --> 01:31:57,590

we're getting wrong

2522

01:32:01,990 --> 01:31:59,280

since in the fundamental theory there's

2523

01:32:04,229 --> 01:32:02,000

no preferred time but there are states

2524

01:32:06,229 --> 01:32:04,239

right there states because

2525

01:32:08,870 --> 01:32:06,239

because

2526
01:32:10,229 --> 01:32:08,880
we don't see the details of the world we

2527
01:32:11,669 --> 01:32:10,239
have an approximate description of the

2528
01:32:14,790 --> 01:32:11,679
world so we give a description of the

2529
01:32:17,910 --> 01:32:14,800
world which is a a a statistical state a

2530
01:32:20,470 --> 01:32:17,920
distribution of a possible configuration

2531
01:32:21,750 --> 01:32:20,480
now given a flow of time it

2532
01:32:23,590 --> 01:32:21,760
it

2533
01:32:24,950 --> 01:32:23,600
determines one particular distribution

2534
01:32:27,270 --> 01:32:24,960
maybe we should

2535
01:32:29,350 --> 01:32:27,280
view the other way around given

2536
01:32:31,590 --> 01:32:29,360
a probabilistic distribution of the

2537
01:32:33,669 --> 01:32:31,600
world what we know about the world

2538
01:32:36,870 --> 01:32:33,679

this determines the flow of time you can

2539

01:32:38,149 --> 01:32:36,880

mathematically compute it that way

2540

01:32:40,790 --> 01:32:38,159

from the

2541

01:32:42,310 --> 01:32:40,800

distribution you can do a simple and and

2542

01:32:44,470 --> 01:32:42,320

in our paper we wrote down this

2543

01:32:45,910 --> 01:32:44,480

mathematical passages

2544

01:32:47,189 --> 01:32:45,920

um

2545

01:32:48,950 --> 01:32:47,199

we

2546

01:32:50,950 --> 01:32:48,960

statistical state of the world produces

2547

01:32:51,750 --> 01:32:50,960

a type variable

2548

01:32:57,350 --> 01:32:51,760

and

2549

01:33:00,229 --> 01:32:57,360

anaconda pushed this father

2550

01:33:05,510 --> 01:33:03,990

if you have a quantum mechanical system

2551

01:33:07,669 --> 01:33:05,520

by necessity

2552

01:33:09,350 --> 01:33:07,679

you have some randomness because quantum

2553

01:33:10,870 --> 01:33:09,360

mechanics is randomness because if you

2554

01:33:13,350 --> 01:33:10,880

remember x and p

2555

01:33:16,870 --> 01:33:13,360

you you you don't commute and this no

2556

01:33:19,750 --> 01:33:16,880

commutativity implies some randomness

2557

01:33:22,310 --> 01:33:19,760

so one of the big big mathematical

2558

01:33:23,910 --> 01:33:22,320

results that alan khon has

2559

01:33:27,110 --> 01:33:23,920

obtained

2560

01:33:30,790 --> 01:33:29,430

using this randomness

2561

01:33:33,350 --> 01:33:30,800

he could show

2562

01:33:35,590 --> 01:33:33,360

that any state

2563

01:33:37,350 --> 01:33:35,600

in the sense of quantum mechanical

2564

01:33:40,149 --> 01:33:37,360

states

2565

01:33:41,910 --> 01:33:40,159

determines a flow of time

2566

01:33:44,229 --> 01:33:41,920

and i don't want to enter into the

2567

01:33:46,550 --> 01:33:44,239

complication of const mathematics is for

2568

01:33:49,350 --> 01:33:46,560

neumann algebras complicated stuff

2569

01:33:51,350 --> 01:33:49,360

in some sense this evolution is unique

2570

01:33:52,629 --> 01:33:51,360

in some very peculiar senses evolution

2571

01:33:53,830 --> 01:33:52,639

is unique

2572

01:33:55,270 --> 01:33:53,840

so what khan is saying that

2573

01:33:57,830 --> 01:33:55,280

automatically once you have the

2574

01:33:59,990 --> 01:33:57,840

randomness of quantum mechanics you have

2575

01:34:02,149 --> 01:34:00,000

a time flow

2576

01:34:03,990 --> 01:34:02,159

the terminal time idea is a simpler

2577

01:34:06,390 --> 01:34:04,000

version of that it's just if you don't

2578

01:34:08,870 --> 01:34:06,400

know the details

2579

01:34:11,030 --> 01:34:08,880

your lack of knowledge of the details is

2580

01:34:14,149 --> 01:34:11,040

such that mathematics is sufficient to

2581

01:34:15,590 --> 01:34:14,159

pick up a specific time flow

2582

01:34:18,709 --> 01:34:15,600

okay

2583

01:34:20,470 --> 01:34:18,719

so uh you see if you study general

2584

01:34:22,390 --> 01:34:20,480

relativity

2585

01:34:24,229 --> 01:34:22,400

the question is uh

2586

01:34:25,590 --> 01:34:24,239

uh which one

2587

01:34:26,950 --> 01:34:25,600

of the variables do you want to call

2588

01:34:28,229 --> 01:34:26,960

time dockable

2589

01:34:30,229 --> 01:34:28,239

and the answer is well they all will

2590

01:34:31,910 --> 01:34:30,239

pre-order the same but

2591

01:34:33,990 --> 01:34:31,920

if you don't know the details and you

2592

01:34:35,750 --> 01:34:34,000

have a foggy version there's one which

2593

01:34:37,669 --> 01:34:35,760

is preferred

2594

01:34:39,750 --> 01:34:37,679

and let me give you

2595

01:34:41,990 --> 01:34:39,760

if i have one more minute on this

2596

01:34:44,709 --> 01:34:42,000

question kurt

2597

01:34:48,070 --> 01:34:44,719

a simple version of this story

2598

01:34:50,149 --> 01:34:48,080

um in special relativity

2599

01:34:51,430 --> 01:34:50,159

you have many time variables because if

2600

01:34:52,790 --> 01:34:51,440

you move uh

2601

01:34:54,229 --> 01:34:52,800

if you and i are moving with respect to

2602

01:34:56,470 --> 01:34:54,239

one another we have different lawrence

2603

01:34:59,030 --> 01:34:56,480

type in the lowest information there's t

2604

01:35:00,790 --> 01:34:59,040

and d prime different times right

2605

01:35:02,390 --> 01:35:00,800

they're all the same it's not one is

2606

01:35:03,910 --> 01:35:02,400

better than than another they're all the

2607

01:35:05,189 --> 01:35:03,920

same okay

2608

01:35:06,950 --> 01:35:05,199

but

2609

01:35:09,430 --> 01:35:06,960

suppose you have a cloud

2610

01:35:12,470 --> 01:35:09,440

which is hot they go out in the universe

2611

01:35:15,030 --> 01:35:12,480

and the cloud is hot

2612

01:35:16,550 --> 01:35:15,040

if it is hot

2613

01:35:18,629 --> 01:35:16,560

okay if you have a number of particles

2614

01:35:21,590 --> 01:35:18,639

that they move there's no preferred time

2615

01:35:23,910 --> 01:35:21,600

but if you have a hot cloud this is hot

2616

01:35:25,910 --> 01:35:23,920

and it has a temperature

2617

01:35:29,270 --> 01:35:25,920

which is determined by the fact that it

2618

01:35:31,030 --> 01:35:29,280

gots in equilibrium with itself

2619

01:35:34,790 --> 01:35:31,040

but it gots in equilibrium in one

2620

01:35:36,870 --> 01:35:34,800

lawrence frame not in all lawrence frame

2621

01:35:38,310 --> 01:35:36,880

it's it's an equilibrium in the frame in

2622

01:35:40,070 --> 01:35:38,320

which the

2623

01:35:45,350 --> 01:35:40,080

the cloud as a whole the center of mass

2624

01:35:50,390 --> 01:35:47,510

it's only in this frame that the

2625

01:35:52,470 --> 01:35:50,400

distribution is the distribution is the

2626

01:35:53,750 --> 01:35:52,480

the boltzmann distribution that you

2627

01:35:55,189 --> 01:35:53,760

expect

2628

01:35:57,510 --> 01:35:55,199

from the

2629

01:36:01,030 --> 01:35:57,520

so if you know the distribution if you

2630

01:36:03,350 --> 01:36:01,040

have a macroscopic description of that

2631

01:36:05,350 --> 01:36:03,360

you pick up a time a preferred lawrence

2632

01:36:06,990 --> 01:36:05,360

time

2633

01:36:08,790 --> 01:36:07,000

so you see

2634

01:36:11,189 --> 01:36:08,800

microscopically

2635

01:36:13,750 --> 01:36:11,199

you don't see any preferred time but

2636

01:36:15,430 --> 01:36:13,760

macroscopically is one preferred time

2637

01:36:17,350 --> 01:36:15,440

and the idea is that that's exactly what

2638

01:36:19,830 --> 01:36:17,360

happened in the world i mean we we live

2639

01:36:21,510 --> 01:36:19,840

in a world we interact with the world

2640

01:36:23,350 --> 01:36:21,520

macroscopically

2641

01:36:25,350 --> 01:36:23,360

obviously there is a past in the future

2642

01:36:27,109 --> 01:36:25,360

obviously there is a

2643

01:36:28,790 --> 01:36:27,119

a time direction

2644

01:36:31,590 --> 01:36:28,800

but that's because we use this

2645

01:36:32,790 --> 01:36:31,600

macroscopic variables if we were

2646

01:36:34,149 --> 01:36:32,800

really

2647

01:36:36,709 --> 01:36:34,159

interacting with all the degrees of

2648

01:36:38,709 --> 01:36:36,719

freedom at the level of generativity

2649

01:36:41,350 --> 01:36:38,719

all variables we will be equally

2650

01:36:43,189 --> 01:36:41,360

temporal variables

2651

01:36:44,629 --> 01:36:43,199

okay so let me see if i can understand

2652

01:36:46,229 --> 01:36:44,639

this now you can correct what i'm saying

2653

01:36:48,070 --> 01:36:46,239

time implies energy implies macrostate

2654

01:36:50,870 --> 01:36:48,080

as we talked about before

2655

01:36:52,390 --> 01:36:50,880

and then you can reverse that but then i

2656

01:36:54,950 --> 01:36:52,400

see that as a trade-off between

2657

01:36:57,750 --> 01:36:54,960

precision so if we were more precise we

2658

01:36:59,109 --> 01:36:57,760

wouldn't see time that's where alan

2659

01:37:00,390 --> 01:36:59,119

which i'm going to mispronounce but the

2660

01:37:02,870 --> 01:37:00,400

french mathematician you mentioned the

2661

01:37:05,590 --> 01:37:02,880

fields medalist alan conus that's elaine

2662

01:37:07,350 --> 01:37:05,600

konis that's where he comes in by saying

2663

01:37:09,510 --> 01:37:07,360

clearly you can never be extremely

2664

01:37:11,109 --> 01:37:09,520

precise anyway given quantum mechanics

2665

01:37:12,790 --> 01:37:11,119

so that's why

2666

01:37:15,350 --> 01:37:12,800

quantum mechanically you can just you

2667

01:37:19,109 --> 01:37:15,360

can induce time in that regard says that

2668

01:37:21,030 --> 01:37:19,119

correct okay correct exactly exactly so

2669

01:37:22,229 --> 01:37:21,040

let me stress that it's a beautiful idea

2670

01:37:23,750 --> 01:37:22,239

i love it

2671

01:37:27,510 --> 01:37:23,760

i think it's right but i'm not sure it's

2672

01:37:29,109 --> 01:37:27,520

a very speculative idea so i'm i i

2673

01:37:30,790 --> 01:37:29,119

people have been complaining about that

2674

01:37:34,550 --> 01:37:30,800

and it's i think it's an open question

2675

01:37:35,750 --> 01:37:34,560

what are their complaints to help us so

2676

01:37:37,990 --> 01:37:35,760

um

2677

01:37:39,990 --> 01:37:38,000

the complaint is that the main complaint

2678

01:37:42,710 --> 01:37:40,000

is that it's not

2679

01:37:44,149 --> 01:37:42,720

developed well enough because

2680

01:37:45,109 --> 01:37:44,159

[Music]

2681

01:37:53,430 --> 01:37:45,119

it

2682

01:37:57,590 --> 01:37:55,590

uh but actually

2683

01:37:59,830 --> 01:37:57,600

what we really

2684

01:38:02,790 --> 01:37:59,840

what really

2685

01:38:04,629 --> 01:38:02,800

what we really do in our life when we

2686

01:38:05,910 --> 01:38:04,639

pick up a time variable is precisely

2687

01:38:07,350 --> 01:38:05,920

because it's not an equilibrium

2688

01:38:09,430 --> 01:38:07,360

situation the past is different from the

2689

01:38:13,270 --> 01:38:09,440

future

2690

01:38:14,709 --> 01:38:13,280

so in a sense it would be good to extend

2691

01:38:17,030 --> 01:38:14,719

this uh

2692

01:38:19,109 --> 01:38:17,040

terminal time outside this simple

2693

01:38:20,550 --> 01:38:19,119

equilibrium case in which past the

2694

01:38:21,910 --> 01:38:20,560

future the equilibrium we don't

2695

01:38:23,109 --> 01:38:21,920

distinguish anymore

2696

01:38:25,750 --> 01:38:23,119

um

2697

01:38:28,790 --> 01:38:25,760

uh past and future to to make this story

2698

01:38:30,470 --> 01:38:28,800

really completely coherent

2699

01:38:32,870 --> 01:38:30,480

now lisa mullen has a book on time as

2700

01:38:35,189 --> 01:38:32,880

well i don't recall the name of it if

2701

01:38:36,790 --> 01:38:35,199

you remember you can just say it

2702

01:38:37,990 --> 01:38:36,800

do you recall

2703

01:38:39,750 --> 01:38:38,000

uh

2704

01:38:41,030 --> 01:38:39,760

no i forgot i was talking about that

2705

01:38:42,310 --> 01:38:41,040

maybe the problem with time i don't know

2706

01:38:44,550 --> 01:38:42,320

because plenty of books called the

2707

01:38:46,629 --> 01:38:44,560

problem with at least in my head okay so

2708

01:38:48,390 --> 01:38:46,639

lee smallin has some views on time and i

2709

01:38:51,109 --> 01:38:48,400

recall him saying that it may be that

2710

01:38:53,430 --> 01:38:51,119

time is the most fundamental

2711

01:38:55,270 --> 01:38:53,440

now it might do firstly does that ring

2712

01:38:57,669 --> 01:38:55,280

true to you just that

2713

01:39:00,709 --> 01:38:57,679

okay great that's what lee thinks

2714

01:39:02,629 --> 01:39:00,719

prior to researching about

2715

01:39:04,470 --> 01:39:02,639

you carlo i was just thinking well lee

2716

01:39:06,709 --> 01:39:04,480

smulling and carla bervelli lupone to

2717

01:39:08,390 --> 01:39:06,719

gravity great let me start to research

2718

01:39:11,189 --> 01:39:08,400

the quantum gravity and i was thinking

2719

01:39:12,629 --> 01:39:11,199

that you pretty much agree with lee on

2720

01:39:14,470 --> 01:39:12,639

everything because in my head you both

2721

01:39:16,310 --> 01:39:14,480

were the same as the popularizers of

2722

01:39:19,030 --> 01:39:16,320

loop quantum gravity and developers of

2723

01:39:20,550 --> 01:39:19,040

it however as i read order of time i saw

2724

01:39:22,870 --> 01:39:20,560

there was a huge disconnect between you

2725

01:39:25,990 --> 01:39:22,880

and him on this level so do you mind

2726

01:39:28,149 --> 01:39:26,000

explaining what lee's views are on time

2727

01:39:30,470 --> 01:39:28,159

if you can and then where and why you

2728

01:39:33,270 --> 01:39:30,480

defer

2729

01:39:34,390 --> 01:39:33,280

yeah so uh let me start by saying that

2730

01:39:36,229 --> 01:39:34,400

lee and i

2731

01:39:39,270 --> 01:39:36,239

have been

2732

01:39:41,510 --> 01:39:39,280

i think we did the best uh physics uh

2733

01:39:43,430 --> 01:39:41,520

together my best physics and his best

2734

01:39:45,750 --> 01:39:43,440

physics probably together

2735

01:39:48,229 --> 01:39:46,870

all the

2736

01:39:49,750 --> 01:39:48,239

not just the beginning of flue quantum

2737

01:39:51,750 --> 01:39:49,760

gravity i mean the start of loop going

2738

01:39:53,990 --> 01:39:51,760

to gravity but also the the the

2739

01:39:55,270 --> 01:39:54,000

calculations of the egg values of the

2740

01:39:57,669 --> 01:39:55,280

area and the operator which are key

2741

01:39:59,109 --> 01:39:57,679

results in in quantum gravity and many

2742

01:40:00,310 --> 01:39:59,119

other things

2743

01:40:01,430 --> 01:40:00,320

um

2744

01:40:03,270 --> 01:40:01,440

so

2745

01:40:05,830 --> 01:40:03,280

uh

2746

01:40:07,109 --> 01:40:05,840

we we succeeded repeatedly collaborating

2747

01:40:08,790 --> 01:40:07,119

well and

2748

01:40:10,950 --> 01:40:08,800

we we

2749

01:40:13,669 --> 01:40:10,960

we have always remained very good

2750

01:40:15,669 --> 01:40:13,679

friends all through our life since since

2751

01:40:17,270 --> 01:40:15,679

our young age when we met

2752

01:40:19,270 --> 01:40:17,280

um so

2753

01:40:25,109 --> 01:40:19,280

he's i count him as a

2754

01:40:28,550 --> 01:40:26,709

however in spite of that or maybe

2755

01:40:31,109 --> 01:40:28,560

precisely because of that

2756

01:40:32,310 --> 01:40:31,119

it's not true at all that we have been

2757

01:40:34,629 --> 01:40:32,320

agreeing

2758

01:40:37,109 --> 01:40:34,639

on ideas all the way through

2759

01:40:39,669 --> 01:40:37,119

in fact i would say even the opposite uh

2760

01:40:41,669 --> 01:40:39,679

we've been able to do physics together

2761

01:40:44,550 --> 01:40:41,679

precisely because we disagreed through

2762

01:40:47,189 --> 01:40:44,560

our disagreement interesting uh through

2763

01:40:53,189 --> 01:40:47,199

long discussions no no you're wrong no

2764

01:40:57,830 --> 01:40:54,950

so the beauty of the

2765

01:40:59,590 --> 01:40:57,840

our collaboration for me has been

2766

01:41:01,750 --> 01:40:59,600

being able to learn from one another

2767

01:41:03,590 --> 01:41:01,760

constantly being constantly challenged

2768

01:41:06,470 --> 01:41:03,600

by the other person

2769

01:41:08,550 --> 01:41:06,480

and uh and and through that getting to

2770

01:41:10,470 --> 01:41:08,560

to to to write down equations to do to

2771

01:41:11,189 --> 01:41:10,480

do calculations to put up theories and

2772

01:41:14,310 --> 01:41:11,199

to

2773

01:41:17,030 --> 01:41:14,320

um

2774

01:41:19,990 --> 01:41:17,040

lee also think this way and lee has a

2775

01:41:21,750 --> 01:41:20,000

very nice way of putting this story

2776

01:41:24,790 --> 01:41:21,760

which i love

2777

01:41:26,470 --> 01:41:24,800

once in an interview um

2778

01:41:28,070 --> 01:41:26,480

somebody asked him about the

2779

01:41:30,229 --> 01:41:28,080

disagreement with me and they thought

2780

01:41:33,750 --> 01:41:30,239

for a while and then said well look

2781

01:41:35,990 --> 01:41:33,760

if we had

2782

01:41:38,470 --> 01:41:36,000

had the same ideas

2783

01:41:41,590 --> 01:41:38,480

then one of the two of us would have

2784

01:41:45,590 --> 01:41:43,750

and i think it's a great idea right so

2785

01:41:46,470 --> 01:41:45,600

it's useless somebody who agrees with

2786

01:41:47,910 --> 01:41:46,480

you

2787

01:41:51,109 --> 01:41:47,920

on everything

2788

01:41:52,390 --> 01:41:51,119

so that's a that's the premise um now

2789

01:41:59,109 --> 01:41:52,400

uh

2790

01:42:00,950 --> 01:41:59,119

which has grown out

2791

01:42:02,550 --> 01:42:00,960

in in in the last decade is precisely

2792

01:42:05,590 --> 01:42:02,560

about time

2793

01:42:06,950 --> 01:42:05,600

uh it's not so strong as

2794

01:42:13,350 --> 01:42:06,960

uh

2795

01:42:15,109 --> 01:42:13,360

common

2796

01:42:18,950 --> 01:42:15,119

um

2797

01:42:21,030 --> 01:42:18,960

points that lee and i agree uh i mean i

2798

01:42:22,629 --> 01:42:21,040

i've been quoted often to say time does

2799

01:42:24,229 --> 01:42:22,639

not exist but

2800

01:42:26,390 --> 01:42:24,239

this is easily

2801

01:42:27,590 --> 01:42:26,400

that's a slogan slogans are

2802

01:42:30,310 --> 01:42:27,600

you know you can take it the way that

2803

01:42:32,070 --> 01:42:30,320

they want and it's easily misinterpreted

2804

01:42:34,229 --> 01:42:32,080

time does not exist does not mean that

2805

01:42:36,470 --> 01:42:34,239

we have to think about reality as just

2806

01:42:37,910 --> 01:42:36,480

static nothing happening

2807

01:42:39,830 --> 01:42:37,920

it's the other way around

2808

01:42:43,030 --> 01:42:39,840

i think that uh

2809

01:42:45,109 --> 01:42:43,040

um you know a static reality is time

2810

01:42:47,430 --> 01:42:45,119

passes nothing happened

2811

01:42:48,390 --> 01:42:47,440

but time passes and nothing happened

2812

01:42:50,229 --> 01:42:48,400

um

2813

01:42:52,390 --> 01:42:50,239

i think we have to think about reality

2814

01:42:55,109 --> 01:42:52,400
as a sequence of happenings

2815

01:42:57,030 --> 01:42:55,119
not a set of things

2816

01:42:58,470 --> 01:42:57,040
before we talked about things but if we

2817

01:43:00,470 --> 01:42:58,480
go into relativity into general

2818

01:43:01,750 --> 01:43:00,480
relativity what we actually describe in

2819

01:43:07,430 --> 01:43:01,760
the

2820

01:43:09,270 --> 01:43:07,440
um even an object

2821

01:43:11,750 --> 01:43:09,280
the object we talked about the pen what

2822

01:43:13,990 --> 01:43:11,760
it really is in in my eyes at the light

2823

01:43:15,590 --> 01:43:14,000
of general activity it's a sequence of

2824

01:43:17,030 --> 01:43:15,600
processes there's something happening

2825

01:43:19,510 --> 01:43:17,040
it's happening now and then now and then

2826

01:43:21,350 --> 01:43:19,520

now and now and it's just pluses and

2827

01:43:22,229 --> 01:43:21,360

resemble one another and this is we call

2828

01:43:23,750 --> 01:43:22,239

the pen

2829

01:43:25,830 --> 01:43:23,760

and sorry so

2830

01:43:28,790 --> 01:43:25,840

to interject when you say happenings are

2831

01:43:30,870 --> 01:43:28,800

they the same as space-time events or is

2832

01:43:32,629 --> 01:43:30,880

that com is that different yeah yeah if

2833

01:43:35,830 --> 01:43:32,639

you want uh uh

2834

01:43:36,709 --> 01:43:35,840

an event it's something that is a it's a

2835

01:43:38,870 --> 01:43:36,719

it's just

2836

01:43:41,669 --> 01:43:38,880

limited in space and time and and

2837

01:43:43,030 --> 01:43:41,679

reality is this is a symbol of this okay

2838

01:43:46,950 --> 01:43:43,040

so uh

2839

01:43:52,070 --> 01:43:49,109

where event means a region of space time

2840

01:43:54,390 --> 01:43:52,080

but also means a something that is

2841

01:43:55,590 --> 01:43:54,400

happening in that regional space time in

2842

01:43:57,510 --> 01:43:55,600

fact

2843

01:44:00,070 --> 01:43:57,520

i think what the reason spray time is is

2844

01:44:01,669 --> 01:44:00,080

just happening right right whatever

2845

01:44:03,189 --> 01:44:01,679

happens in that region that's what the

2846

01:44:04,709 --> 01:44:03,199

regional space time is

2847

01:44:06,310 --> 01:44:04,719

and what happened is that there is a

2848

01:44:07,669 --> 01:44:06,320

field there is a gravitational field

2849

01:44:09,669 --> 01:44:07,679

there is electromagnetic field or

2850

01:44:12,390 --> 01:44:09,679

electrons whatever happens there

2851

01:44:13,830 --> 01:44:12,400

and if there are no electrons and no

2852

01:44:15,990 --> 01:44:13,840

uh electromagnetic field there is still

2853

01:44:17,270 --> 01:44:16,000

the gravitational field and if you take

2854

01:44:18,870 --> 01:44:17,280

away the electromagnetic field there's

2855

01:44:20,550 --> 01:44:18,880

nothing happening there's no that

2856

01:44:21,750 --> 01:44:20,560

reaches place time is not there

2857

01:44:24,310 --> 01:44:21,760

all right

2858

01:44:26,470 --> 01:44:24,320

so this hap this happening view of the

2859

01:44:28,709 --> 01:44:26,480

world is something lee is insisting a

2860

01:44:30,229 --> 01:44:28,719

lot and i also agree with him completely

2861

01:44:32,950 --> 01:44:30,239

100

2862

01:44:35,189 --> 01:44:32,960

we should talk about that this dynamical

2863

01:44:37,270 --> 01:44:35,199

aspect of all the processes not the

2864

01:44:38,310 --> 01:44:37,280

entities in isolation so that's the part

2865

01:44:40,470 --> 01:44:38,320

we agree

2866

01:44:42,310 --> 01:44:40,480

it's a big part

2867

01:44:44,629 --> 01:44:42,320

so all the people who talk about the

2868

01:44:46,830 --> 01:44:44,639

static four-dimensional universe

2869

01:44:49,830 --> 01:44:46,840

frozen time

2870

01:44:52,550 --> 01:44:49,840

um a block universe

2871

01:44:54,790 --> 01:44:52,560

i think it's misleading block universe

2872

01:44:56,629 --> 01:44:54,800

is just a you know a picture in our head

2873

01:44:59,510 --> 01:44:56,639

of an ensemble

2874

01:45:01,669 --> 01:44:59,520

of of events if i think of the story of

2875

01:45:03,430 --> 01:45:01,679

your life kurt

2876

01:45:05,510 --> 01:45:03,440

a block universe story of love lies

2877

01:45:06,950 --> 01:45:05,520

things happened okay it's a symbol of

2878

01:45:09,030 --> 01:45:06,960

happenings good

2879

01:45:12,629 --> 01:45:09,040

so it's the same for the universe

2880

01:45:15,189 --> 01:45:12,639

now where do lee and i disagree

2881

01:45:16,550 --> 01:45:15,199

we disagree about the origin of the

2882

01:45:18,709 --> 01:45:16,560

distinction within the past and the

2883

01:45:20,709 --> 01:45:18,719

future

2884

01:45:22,470 --> 01:45:20,719

that's the disagreement

2885

01:45:24,870 --> 01:45:22,480

lee

2886

01:45:26,550 --> 01:45:24,880

holds on to the idea

2887

01:45:29,350 --> 01:45:26,560

that the past and the future

2888

01:45:32,070 --> 01:45:29,360

intrinsically and profoundly different

2889

01:45:34,149 --> 01:45:32,080

at the sort of fundamental level

2890

01:45:34,950 --> 01:45:34,159

so these happenings are happening from

2891

01:45:38,550 --> 01:45:34,960

the

2892

01:45:40,950 --> 01:45:38,560

something

2893

01:45:43,430 --> 01:45:40,960

the past exists fix it has happened it

2894

01:45:45,910 --> 01:45:43,440

is unchangeable the future is generally

2895

01:45:48,390 --> 01:45:45,920

open ah interesting okay that's a

2896

01:45:51,189 --> 01:45:48,400

disagreement i disagree with that i

2897

01:45:53,350 --> 01:45:51,199

think that uh

2898

01:45:54,950 --> 01:45:53,360

it seems to me that our best physics is

2899

01:45:56,470 --> 01:45:54,960

telling us

2900

01:45:58,950 --> 01:45:56,480

that this

2901
01:46:00,310 --> 01:45:58,960
very vivid difference between the past

2902
01:46:02,149 --> 01:46:00,320
and the future

2903
01:46:04,709 --> 01:46:02,159
is not in the grammar of neutrons

2904
01:46:06,229 --> 01:46:04,719
elementary grammar of nature it only

2905
01:46:08,470 --> 01:46:06,239
comes in

2906
01:46:11,270 --> 01:46:08,480
at the statistical thermodynamical level

2907
01:46:13,430 --> 01:46:11,280
when we have a

2908
01:46:15,109 --> 01:46:13,440
macroscopic description and therefore we

2909
01:46:16,229 --> 01:46:15,119
have entropy and therefore we have

2910
01:46:18,070 --> 01:46:16,239
things you know

2911
01:46:20,470 --> 01:46:18,080
ice melting down

2912
01:46:22,390 --> 01:46:20,480
uh and and and all the reversible

2913
01:46:24,229 --> 01:46:22,400

phenomena the all the irreversible

2914

01:46:26,990 --> 01:46:24,239

phenomena microscopic

2915

01:46:29,430 --> 01:46:27,000

the irreversibility uh

2916

01:46:30,790 --> 01:46:29,440

characterizes the microscopic variables

2917

01:46:32,550 --> 01:46:30,800

there's no irreversibility of the

2918

01:46:34,070 --> 01:46:32,560

microscopic variable

2919

01:46:35,910 --> 01:46:34,080

so the distinction between the past and

2920

01:46:37,669 --> 01:46:35,920

the future in my opinion

2921

01:46:39,030 --> 01:46:37,679

it's only for big things an electron

2922

01:46:41,830 --> 01:46:39,040

doesn't distinguish the past of the

2923

01:46:45,109 --> 01:46:41,840

future an atom does not distinguish the

2924

01:46:47,830 --> 01:46:45,119

past in the future a glass of water

2925

01:46:50,390 --> 01:46:47,840

with ice and water does distinguish

2926

01:46:51,669 --> 01:46:50,400

but the distinction is in the in the

2927

01:46:53,270 --> 01:46:51,679

picture

2928

01:46:56,229 --> 01:46:53,280

in the words

2929

01:46:58,470 --> 01:46:56,239

glass water and eyes it's a macroscopic

2930

01:47:00,390 --> 01:46:58,480

description so that's that's the point

2931

01:47:03,030 --> 01:47:00,400

where we disagree so we

2932

01:47:04,229 --> 01:47:03,040

you know the philosophical idea that

2933

01:47:05,430 --> 01:47:04,239

it's a

2934

01:47:07,109 --> 01:47:05,440

the description of the world is about

2935

01:47:09,030 --> 01:47:07,119

happenings and not about things not

2936

01:47:11,350 --> 01:47:09,040

about static

2937

01:47:12,790 --> 01:47:11,360

we're really on the same ground

2938

01:47:14,629 --> 01:47:12,800

but the

2939

01:47:17,030 --> 01:47:14,639

orientation of this happening is this

2940

01:47:18,310 --> 01:47:17,040

happening oriented in time from the past

2941

01:47:19,990 --> 01:47:18,320

to the future

2942

01:47:21,430 --> 01:47:20,000

is where we disagree i think that it

2943

01:47:22,870 --> 01:47:21,440

comes later on

2944

01:47:24,950 --> 01:47:22,880

at the fundamental level should forget

2945

01:47:26,790 --> 01:47:24,960

about that the the laws just don't

2946

01:47:28,629 --> 01:47:26,800

distinguish between the two

2947

01:47:30,950 --> 01:47:28,639

and lee thinks that in some sense the

2948

01:47:33,430 --> 01:47:30,960

laws distinguish between the two

2949

01:47:35,669 --> 01:47:33,440

so what does he say in response to

2950

01:47:37,430 --> 01:47:35,679

your justification for saying that it's

2951

01:47:39,350 --> 01:47:37,440

the blurriness that generates time or

2952

01:47:42,709 --> 01:47:39,360

the macroscopic states

2953

01:47:48,629 --> 01:47:46,550

they say you be you you be you carlo

2954

01:48:03,830 --> 01:47:48,639

i

2955

01:48:06,550 --> 01:48:03,840

all

2956

01:48:11,590 --> 01:48:06,560

i my reading but he might he might

2957

01:48:16,950 --> 01:48:13,669

the intuition of the difference between

2958

01:48:19,990 --> 01:48:16,960

past and future for him is so strong

2959

01:48:22,390 --> 01:48:20,000

um so he's holding on to this romantic

2960

01:48:23,669 --> 01:48:22,400

idea of ex experiential time and wanting

2961

01:48:29,750 --> 01:48:23,679

to

2962

01:48:31,669 --> 01:48:29,760

okay so that's my reading right

2963

01:48:33,189 --> 01:48:31,679

that's my reading but you know he might

2964

01:48:36,149 --> 01:48:33,199

answer something else

2965

01:48:38,550 --> 01:48:36,159

okay what about janice sorry what about

2966

01:48:39,910 --> 01:48:38,560

julian barber the janice oh julian yeah

2967

01:48:42,149 --> 01:48:39,920

now i haven't had a chance to read his

2968

01:48:44,790 --> 01:48:42,159

book i started reading it but i don't

2969

01:48:45,830 --> 01:48:44,800

know what his theory is i think as far

2970

01:48:48,390 --> 01:48:45,840

as i got was just the history of

2971

01:48:50,550 --> 01:48:48,400

thermodynamics so what is the janus

2972

01:48:52,149 --> 01:48:50,560

point what is his theory on time and

2973

01:48:54,950 --> 01:48:52,159

then obviously compare and contrast with

2974

01:48:59,669 --> 01:48:57,270

so a few coordinates here

2975

01:49:02,629 --> 01:48:59,679

first of all julian it's a fantastic

2976

01:49:04,870 --> 01:49:02,639

historian of science he wrote

2977

01:49:07,669 --> 01:49:04,880

a big thick scholarly book on the

2978

01:49:11,030 --> 01:49:07,679

history of mechanics which is a total

2979

01:49:12,709 --> 01:49:11,040

masterpiece in my opinion

2980

01:49:14,790 --> 01:49:12,719

um

2981

01:49:17,910 --> 01:49:14,800

then he uh

2982

01:49:21,030 --> 01:49:17,920

it's known for two ideas about time one

2983

01:49:23,750 --> 01:49:21,040

uh uh which is uh several

2984

01:49:24,550 --> 01:49:23,760

that's is mostly known for that

2985

01:49:26,470 --> 01:49:24,560

uh

2986

01:49:30,870 --> 01:49:26,480

some time ago um

2987

01:49:32,229 --> 01:49:30,880

his uh idea that we should think uh

2988

01:49:35,109 --> 01:49:32,239

at uh

2989

01:49:37,910 --> 01:49:35,119

at the world in a completely timeless

2990

01:49:39,750 --> 01:49:37,920

way just a distribution probability as

2991

01:49:40,830 --> 01:49:39,760

instantaneous

2992

01:49:42,629 --> 01:49:40,840

um

2993

01:49:45,510 --> 01:49:42,639

configurations

2994

01:49:46,550 --> 01:49:45,520

and recently he came out with a new idea

2995

01:49:49,350 --> 01:49:46,560

uh

2996

01:49:52,629 --> 01:49:49,360

which is this janus point

2997

01:49:54,629 --> 01:49:52,639

so uh i distinguish

2998

01:49:56,870 --> 01:49:54,639

three barbus

2999

01:50:00,149 --> 01:49:56,880

bubbles the bible's the historian of

3000

01:50:03,430 --> 01:50:00,159

physics and which you know chapel as the

3001
01:50:06,070 --> 01:50:03,440
uh french say i mean infinite uh respect

3002
01:50:10,390 --> 01:50:06,080
of him i learned so much from him

3003
01:50:12,390 --> 01:50:10,400
um barbara as the guy denying uh time in

3004
01:50:15,589 --> 01:50:12,400
the sense of uh

3005
01:50:17,830 --> 01:50:15,599
his old book on time and the third bible

3006
01:50:18,950 --> 01:50:17,840
which is about this childish point

3007
01:50:20,470 --> 01:50:18,960
so

3008
01:50:23,669 --> 01:50:20,480
the second one

3009
01:50:25,750 --> 01:50:23,679
i was never convinced much because here

3010
01:50:29,430 --> 01:50:25,760
complicated story about the universe

3011
01:50:32,070 --> 01:50:29,440
being extended in space but not in time

3012
01:50:34,870 --> 01:50:32,080
uh which i did not find convincing i i

3013
01:50:36,149 --> 01:50:34,880

we could go into that uh but this

3014

01:50:38,149 --> 01:50:36,159

we should not talk about that and we

3015

01:50:41,109 --> 01:50:38,159

should talk about the third one and the

3016

01:50:43,189 --> 01:50:41,119

third one this janus point idea uh it's

3017

01:50:45,990 --> 01:50:43,199

indeed uh um

3018

01:50:47,189 --> 01:50:46,000

quite uh um

3019

01:50:49,510 --> 01:50:47,199

intriguing

3020

01:50:52,390 --> 01:50:49,520

he's not the only one who has been

3021

01:50:54,149 --> 01:50:52,400

recently talking about sean carroll has

3022

01:50:56,229 --> 01:50:54,159

also

3023

01:50:58,790 --> 01:50:56,239

considered this idea there is there is

3024

01:51:04,229 --> 01:50:58,800

an increasing attention to this idea

3025

01:51:08,470 --> 01:51:05,589

we are wrong

3026

01:51:10,229 --> 01:51:08,480

when we say that generically

3027

01:51:12,470 --> 01:51:10,239

if you take a system

3028

01:51:14,310 --> 01:51:12,480

generically most solutions of

3029

01:51:17,189 --> 01:51:14,320

integration of motion is in equilibrium

3030

01:51:19,270 --> 01:51:17,199

so there is no past and future

3031

01:51:21,589 --> 01:51:19,280

um

3032

01:51:23,910 --> 01:51:21,599

it's true that if you if you if you put

3033

01:51:26,229 --> 01:51:23,920

the gas in a box and you close it

3034

01:51:27,750 --> 01:51:26,239

with a fixed amount of energy

3035

01:51:29,669 --> 01:51:27,760

uh

3036

01:51:31,990 --> 01:51:29,679

most possible solutions or where the gas

3037

01:51:33,430 --> 01:51:32,000

goes in long time is in equilibrium and

3038

01:51:37,669 --> 01:51:33,440

in the equilibrium the entropy is

3039

01:51:42,709 --> 01:51:39,510

so then we have to say why the entropy

3040

01:51:44,229 --> 01:51:42,719

was low in the past it seems strange

3041

01:51:46,149 --> 01:51:44,239

the point is that the universe is not

3042

01:51:48,310 --> 01:51:46,159

like a gas in a box that's the main

3043

01:51:49,430 --> 01:51:48,320

observation that also sounds like when

3044

01:51:51,750 --> 01:51:49,440

we were talking about that there are

3045

01:51:53,589 --> 01:51:51,760

some problems with applying our limited

3046

01:51:55,030 --> 01:51:53,599

scale physics or when we do experiments

3047

01:51:56,629 --> 01:51:55,040

to the universe as a whole i think

3048

01:51:58,149 --> 01:51:56,639

that's where i got it from was reading

3049

01:52:00,229 --> 01:51:58,159

the janus point he was saying the

3050

01:52:02,070 --> 01:52:00,239

universe is not a box so you can't apply

3051
01:52:05,109 --> 01:52:02,080
the same laws of thermodynamics to the

3052
01:52:06,870 --> 01:52:05,119
universe as a whole yes exactly so but

3053
01:52:09,189 --> 01:52:06,880
there's a specific very very specific

3054
01:52:10,629 --> 01:52:09,199
reason for which you cannot

3055
01:52:13,189 --> 01:52:10,639
that

3056
01:52:15,189 --> 01:52:13,199
there is no equilibrium state because

3057
01:52:17,030 --> 01:52:15,199
if you think about the imagine the

3058
01:52:19,510 --> 01:52:17,040
universe just a bunch of particles in an

3059
01:52:20,870 --> 01:52:19,520
infinite space okay they can spread

3060
01:52:23,510 --> 01:52:20,880
forever

3061
01:52:24,550 --> 01:52:23,520
okay so they never get to real

3062
01:52:26,470 --> 01:52:24,560
uh

3063
01:52:28,830 --> 01:52:26,480

to real equilibrium

3064

01:52:30,709 --> 01:52:28,840

so let's consider one possible

3065

01:52:32,870 --> 01:52:30,719

configuration okay

3066

01:52:35,030 --> 01:52:32,880

of this particle okay

3067

01:52:36,790 --> 01:52:35,040

a generic one they would just move

3068

01:52:39,350 --> 01:52:36,800

somehow maybe they come close at some

3069

01:52:40,629 --> 01:52:39,360

point and then they disperse

3070

01:52:43,510 --> 01:52:40,639

so if you look at the future they

3071

01:52:45,030 --> 01:52:43,520

disperse if you come back there's some

3072

01:52:47,990 --> 01:52:45,040

moment in which they're closer and then

3073

01:52:50,790 --> 01:52:48,000

they disperse again

3074

01:52:52,229 --> 01:52:50,800

so the entropy in that configuration

3075

01:52:55,189 --> 01:52:52,239

okay

3076
01:52:56,629 --> 01:52:55,199
it's up goes to a minimum and then grows

3077
01:52:58,950 --> 01:52:56,639
of course there's no preferred direction

3078
01:53:00,310 --> 01:52:58,960
of time because you know both directions

3079
01:53:02,550 --> 01:53:00,320
disperse

3080
01:53:04,390 --> 01:53:02,560
but there's a minimum

3081
01:53:05,910 --> 01:53:04,400
so if you're on one side the entropy is

3082
01:53:07,109 --> 01:53:05,920
growing like that if you're on the other

3083
01:53:12,070 --> 01:53:07,119
side

3084
01:53:13,990 --> 01:53:12,080
of course the entropy is growing right

3085
01:53:16,310 --> 01:53:14,000
if think a mountain

3086
01:53:17,990 --> 01:53:16,320
any mountains it has you know one

3087
01:53:20,149 --> 01:53:18,000
direction which is down and the other

3088
01:53:21,750 --> 01:53:20,159

direction which is up so generically

3089

01:53:23,990 --> 01:53:21,760

there's always one direction down one

3090

01:53:26,709 --> 01:53:24,000

direction up

3091

01:53:28,790 --> 01:53:26,719

so the idea is well maybe we got

3092

01:53:30,470 --> 01:53:28,800

confused about the model of the gas in

3093

01:53:32,950 --> 01:53:30,480

the box and the equilibrium forget the

3094

01:53:36,229 --> 01:53:32,960

equilibrium maybe the right way is

3095

01:53:39,669 --> 01:53:36,239

thinking that generically uh

3096

01:53:41,189 --> 01:53:39,679

histories possible history of the world

3097

01:53:43,350 --> 01:53:41,199

uh

3098

01:53:44,950 --> 01:53:43,360

evolved in some way and necessarily

3099

01:53:47,189 --> 01:53:44,960

there is one point which is minimal

3100

01:53:48,790 --> 01:53:47,199

entropy and then it goes one side and

3101
01:53:50,310 --> 01:53:48,800
the other this is the core updating

3102
01:53:52,629 --> 01:53:50,320
maybe i'm oversimplifying it a little

3103
01:53:55,109 --> 01:53:52,639
bit but that's a coral idea

3104
01:53:57,030 --> 01:53:55,119
so um

3105
01:54:01,750 --> 01:53:57,040
there are some

3106
01:54:04,149 --> 01:54:01,760
possible doubts i'm not sure is

3107
01:54:07,430 --> 01:54:04,159
it's really a solution of the

3108
01:54:09,189 --> 01:54:07,440
of of the end of of which problem or the

3109
01:54:10,229 --> 01:54:09,199
problem why the entropy is low in the

3110
01:54:11,589 --> 01:54:10,239
past

3111
01:54:14,550 --> 01:54:11,599
this you know

3112
01:54:16,470 --> 01:54:14,560
why the time is oriented because in the

3113
01:54:18,470 --> 01:54:16,480

in the past it was low entropy so why in

3114

01:54:21,430 --> 01:54:18,480

the past of the slow entropy

3115

01:54:23,430 --> 01:54:21,440

that's an attempt to answer that

3116

01:54:25,510 --> 01:54:23,440

question

3117

01:54:26,950 --> 01:54:25,520

there is something ringing very

3118

01:54:29,430 --> 01:54:26,960

interesting and i think there's a

3119

01:54:31,750 --> 01:54:29,440

discussion going on right now

3120

01:54:33,030 --> 01:54:31,760

among theoretical physicists and

3121

01:54:34,629 --> 01:54:33,040

philosophers

3122

01:54:37,109 --> 01:54:34,639

uh on

3123

01:54:39,510 --> 01:54:37,119

should we buy this argument is it

3124

01:54:40,790 --> 01:54:39,520

correct um i'm interested in the

3125

01:54:43,669 --> 01:54:40,800

discussion

3126

01:54:44,790 --> 01:54:43,679

and i i hope that in some years it will

3127

01:54:47,030 --> 01:54:44,800

clean up

3128

01:54:47,990 --> 01:54:47,040

namely yes that's a good way of of

3129

01:54:50,550 --> 01:54:48,000

thinking

3130

01:54:52,310 --> 01:54:50,560

about uh why entropy was low in the past

3131

01:54:53,350 --> 01:54:52,320

one direction which is the one we call

3132

01:54:54,790 --> 01:54:53,360

the past

3133

01:54:56,550 --> 01:54:54,800

uh or

3134

01:54:58,550 --> 01:54:56,560

uh no come on we're getting confused

3135

01:55:01,189 --> 01:54:58,560

about probabilities here

3136

01:55:03,430 --> 01:55:01,199

you're it's you're super tissually

3137

01:55:07,189 --> 01:55:03,440

squeezing in some some

3138

01:55:10,070 --> 01:55:07,199

some some intuition which is not correct

3139

01:55:10,870 --> 01:55:10,080

i i don't know it's a it's it's um

3140

01:55:12,470 --> 01:55:10,880

it's

3141

01:55:13,669 --> 01:55:12,480

relatively recent

3142

01:55:18,790 --> 01:55:13,679

that

3143

01:55:20,470 --> 01:55:18,800

and uh i'm i'm open to to this idea i

3144

01:55:22,229 --> 01:55:20,480

found it interesting

3145

01:55:24,229 --> 01:55:22,239

this minimum point does he say that's

3146

01:55:25,910 --> 01:55:24,239

the big bang or does the big bang happen

3147

01:55:28,390 --> 01:55:25,920

at somewhere on the up so it's still

3148

01:55:30,310 --> 01:55:28,400

relatively yeah in a sense that in a

3149

01:55:32,629 --> 01:55:30,320

sense that's what's called the janus

3150

01:55:36,629 --> 01:55:32,639

point because genesis is god

3151

01:55:39,910 --> 01:55:36,639

in in rome it's it's latin god

3152

01:55:42,390 --> 01:55:39,920

um which is the god of the doors of the

3153

01:55:44,470 --> 01:55:42,400

of the change of the year it has two two

3154

01:55:46,790 --> 01:55:44,480

faces it was always

3155

01:55:48,629 --> 01:55:46,800

represented with a head with two faces

3156

01:55:50,709 --> 01:55:48,639

one face is this way one face is the

3157

01:55:52,950 --> 01:55:50,719

other way so the janus point is the

3158

01:55:55,030 --> 01:55:52,960

point where the future you know the one

3159

01:55:56,310 --> 01:55:55,040

future this way one future that way

3160

01:55:57,910 --> 01:55:56,320

because uh

3161

01:55:59,589 --> 01:55:57,920

the future is determined by end to the

3162

01:56:02,310 --> 01:55:59,599

glowing so this is the minimum of the

3163

01:56:04,390 --> 01:56:02,320

entropy so entropy goes this way and it

3164

01:56:06,629 --> 01:56:04,400

goes this way so whoever is here or

3165

01:56:07,990 --> 01:56:06,639

whenever you are here you see the future

3166

01:56:10,709 --> 01:56:08,000

this way whenever here you see the

3167

01:56:12,470 --> 01:56:10,719

future this way so you always see the

3168

01:56:14,550 --> 01:56:12,480

right the big bang in the past right

3169

01:56:16,709 --> 01:56:14,560

that's what you call the best yeah

3170

01:56:17,830 --> 01:56:16,719

interesting interesting okay now to

3171

01:56:19,830 --> 01:56:17,840

wolfram

3172

01:56:21,270 --> 01:56:19,840

which we can take out so don't worry

3173

01:56:24,070 --> 01:56:21,280

do you have any

3174

01:56:26,870 --> 01:56:24,080

thoughts on wolfram's model critiques

3175

01:56:29,430 --> 01:56:27,910

what do you find interesting when you

3176

01:56:31,030 --> 01:56:29,440

find out interesting convincing not

3177

01:56:32,550 --> 01:56:31,040

convincing

3178

01:56:35,270 --> 01:56:32,560

um

3179

01:56:35,280 --> 01:56:39,229

i am not uh

3180

01:56:44,790 --> 01:56:40,870

overexcited

3181

01:56:51,109 --> 01:56:44,800

by the idea that a simple classical

3182

01:56:55,990 --> 01:56:53,589

microscopical model

3183

01:56:57,669 --> 01:56:56,000

could

3184

01:56:59,830 --> 01:56:57,679

you reproduce

3185

01:57:04,709 --> 01:56:59,840

the

3186

01:57:06,229 --> 01:57:04,719

that that we see uh why do you call it a

3187

01:57:07,990 --> 01:57:06,239

classical model

3188

01:57:11,750 --> 01:57:08,000

because it's definite the hypergraph is

3189

01:57:16,550 --> 01:57:14,550

uh it's classically in the sense that uh

3190

01:57:17,830 --> 01:57:16,560

uh you can view this as evolution in

3191

01:57:20,070 --> 01:57:17,840

time and at

3192

01:57:22,550 --> 01:57:20,080

each specific steps moment there are

3193

01:57:24,870 --> 01:57:22,560

there are steps uh the fundamental

3194

01:57:27,830 --> 01:57:24,880

variables which have a

3195

01:57:30,550 --> 01:57:27,840

a unique value so in that sense

3196

01:57:32,629 --> 01:57:30,560

is classical quantum mechanics

3197

01:57:34,229 --> 01:57:32,639

variables don't don't have a specific

3198

01:57:36,229 --> 01:57:34,239

value

3199

01:57:38,470 --> 01:57:36,239

um

3200

01:57:40,310 --> 01:57:38,480

i think that to

3201

01:57:42,550 --> 01:57:40,320

from here

3202

01:57:45,109 --> 01:57:42,560

to reconstruct the complexity of quantum

3203

01:57:48,550 --> 01:57:45,119

mechanics in full

3204

01:57:50,310 --> 01:57:48,560

has not been done yet i have not seen it

3205

01:57:53,669 --> 01:57:50,320

uh yet

3206

01:57:54,709 --> 01:57:53,679

and uh i i i doubt that one could

3207

01:57:58,310 --> 01:57:54,719

actually

3208

01:58:00,950 --> 01:57:58,320

uh do it unless i see it in in detail

3209

01:58:01,750 --> 01:58:00,960

there are aspects of quantum mechanics

3210

01:58:06,709 --> 01:58:01,760

um

3211

01:58:08,790 --> 01:58:06,719

like those uh captured by uh coconut

3212

01:58:09,830 --> 01:58:08,800

spectre theorem

3213

01:58:13,589 --> 01:58:09,840

uh

3214

01:58:16,149 --> 01:58:13,599

or by the bell inequalities

3215

01:58:18,709 --> 01:58:16,159

which are very hard to reproduce this

3216

01:58:22,070 --> 01:58:18,719

way notoriously very hard to reproduce

3217

01:58:24,629 --> 01:58:22,080

this way so um

3218

01:58:26,229 --> 01:58:24,639

one might copy some aspect of quantum

3219

01:58:27,910 --> 01:58:26,239

mechanics

3220

01:58:30,229 --> 01:58:27,920

uh

3221

01:58:31,750 --> 01:58:30,239

i i haven't seen

3222

01:58:32,830 --> 01:58:31,760

the full prediction of quantum mechanics

3223

01:58:35,830 --> 01:58:32,840

coming out

3224

01:58:37,430 --> 01:58:35,840

yet what about for general relativity i

3225

01:58:39,030 --> 01:58:37,440

don't know if you've heard the claims or

3226

01:58:42,149 --> 01:58:39,040

read the paper

3227

01:58:43,669 --> 01:58:42,159

that the hypergraph model can reproduce

3228

01:58:45,750 --> 01:58:43,679

and you can tell me yeah just so you

3229

01:58:47,589 --> 01:58:45,760

know my naive assessment

3230

01:58:49,750 --> 01:58:47,599

i believe what they do is an adm

3231

01:58:51,430 --> 01:58:49,760

decomposition at some point and so

3232

01:58:53,350 --> 01:58:51,440

whenever i hear that

3233

01:58:55,589 --> 01:58:53,360

it to me okay so you're foliating so

3234

01:58:57,189 --> 01:58:55,599

then you have a preferred time and for

3235

01:58:59,669 --> 01:58:57,199

some reason that

3236

01:59:01,589 --> 01:58:59,679

i'm averse to that because space time to

3237

01:59:03,669 --> 01:59:01,599

me shouldn't be able to at least

3238

01:59:05,109 --> 01:59:03,679

generically it's not able to be foliated

3239

01:59:06,709 --> 01:59:05,119

but i don't know if that's if that's

3240

01:59:08,629 --> 01:59:06,719

just my own personal taste and i should

3241

01:59:10,709 --> 01:59:08,639

or if that's an actual argument against

3242

01:59:11,830 --> 01:59:10,719

or for it okay this is your personal

3243

01:59:18,070 --> 01:59:11,840

taste

3244

01:59:20,790 --> 01:59:18,080

but it's not an argument because

3245

01:59:23,990 --> 01:59:20,800

if it was possible to derive

3246

01:59:25,830 --> 01:59:24,000

uh all the

3247

01:59:27,350 --> 01:59:25,840

all of the theory

3248

01:59:29,109 --> 01:59:27,360

from a completely different point of

3249

01:59:30,709 --> 01:59:29,119

view namely not the point of view of

3250

01:59:32,550 --> 01:59:30,719

general covariance not the point of view

3251

01:59:33,589 --> 01:59:32,560

of einstein but from the point of view

3252

01:59:38,070 --> 01:59:33,599

of

3253

01:59:38,080 --> 01:59:43,510

then okay we would have to confront that

3254

01:59:45,750 --> 01:59:44,870

but once again

3255

01:59:47,990 --> 01:59:45,760

um

3256

01:59:48,790 --> 01:59:48,000

there's some aspect of generativity

3257

01:59:50,709 --> 01:59:48,800

which

3258

01:59:51,669 --> 01:59:50,719

has been recovered

3259

01:59:54,149 --> 01:59:51,679

well

3260

01:59:56,830 --> 01:59:54,159

i i i tried to read some of the papers

3261

01:59:59,270 --> 01:59:56,840

over the copy of general relativity

3262

02:00:01,510 --> 01:59:59,280

um you know

3263

02:00:02,870 --> 02:00:01,520

it's

3264

02:00:06,149 --> 02:00:02,880

if you're something

3265

02:00:07,830 --> 02:00:06,159

geometrical and you go at large scale uh

3266

02:00:10,870 --> 02:00:07,840

generativity it's uh

3267

02:00:14,629 --> 02:00:10,880

come up it's not too hard to

3268

02:00:15,589 --> 02:00:14,639

uh to come out with uh uh with the icing

3269

02:00:16,629 --> 02:00:15,599

equations

3270

02:00:18,870 --> 02:00:16,639

uh

3271

02:00:22,550 --> 02:00:18,880

but once again this is not full

3272

02:00:25,589 --> 02:00:22,560

generativity uh yet and if it is food

3273

02:00:28,070 --> 02:00:25,599

generativity it would predict definitely

3274

02:00:29,189 --> 02:00:28,080

corrections to generativity

3275

02:00:30,149 --> 02:00:29,199

uh

3276

02:00:32,550 --> 02:00:30,159

which

3277

02:00:33,669 --> 02:00:32,560

we would be testable

3278

02:00:37,910 --> 02:00:33,679

okay

3279

02:00:43,830 --> 02:00:40,709

this testing namely that generativity is

3280

02:00:46,629 --> 02:00:43,840

factually wrong on some short scale

3281

02:00:47,669 --> 02:00:46,639

and and we see the discrepancy

3282

02:00:50,470 --> 02:00:47,679

um

3283

02:00:53,109 --> 02:00:50,480

i would say well this is a

3284

02:00:56,790 --> 02:00:53,119

more complicated way of saying the same

3285

02:00:58,310 --> 02:00:56,800

story which it's distinguishable

3286

02:01:00,310 --> 02:00:58,320

and it's based on different principles

3287

02:01:01,990 --> 02:01:00,320

which are not the ones which seem to be

3288

02:01:03,830 --> 02:01:02,000

implementing the world namely in the

3289

02:01:05,669 --> 02:01:03,840

world it seems to be that it's another

3290

02:01:06,790 --> 02:01:05,679

reference frame as you say there is no

3291

02:01:09,109 --> 02:01:06,800

preferred for

3292

02:01:09,910 --> 02:01:09,119

foliation as you say so that's the kind

3293

02:01:11,910 --> 02:01:09,920

of things we have learned from

3294

02:01:13,430 --> 02:01:11,920

generativity so why do we have to give

3295

02:01:16,229 --> 02:01:13,440

them up

3296

02:01:20,790 --> 02:01:18,310

you know let's go to copernicus once

3297

02:01:23,350 --> 02:01:20,800

again after copernicus um

3298

02:01:25,669 --> 02:01:23,360

did his model it it seemed to work very

3299

02:01:27,589 --> 02:01:25,679

well on something one thing it did work

3300

02:01:29,750 --> 02:01:27,599

very well is that if you if you make the

3301

02:01:32,149 --> 02:01:29,760

other planets go around the sun

3302

02:01:35,030 --> 02:01:32,159

uh you understand why

3303

02:01:36,629 --> 02:01:35,040

uh the the other planets have a feature

3304

02:01:38,070 --> 02:01:36,639

of the emotion which have a period of

3305

02:01:39,350 --> 02:01:38,080

one year

3306

02:01:42,229 --> 02:01:39,360

because they go around the sun so of

3307

02:01:45,510 --> 02:01:43,510

but the

3308

02:01:47,589 --> 02:01:45,520

strongly counter-intuitive things was

3309

02:01:48,390 --> 02:01:47,599

the earth's move

3310

02:01:53,350 --> 02:01:48,400

so

3311

02:01:55,750 --> 02:01:53,360

greatest astronomer uh

3312

02:01:57,669 --> 02:01:55,760

that uh you know kepler used his data

3313

02:01:59,589 --> 02:01:57,679

for for doing his work

3314

02:02:01,589 --> 02:01:59,599

ticklebride came out with a system which

3315

02:02:04,070 --> 02:02:01,599

is called the ticonic system the system

3316

02:02:07,669 --> 02:02:04,080

of t cobra which was intermediate

3317

02:02:10,229 --> 02:02:07,679

between um copernicus and uh

3318

02:02:11,350 --> 02:02:10,239

america uh and ptolemy which was that

3319

02:02:12,790 --> 02:02:11,360

the earth is the center of the universe

3320

02:02:15,350 --> 02:02:12,800

the earth is fixed so there's nothing

3321

02:02:16,870 --> 02:02:15,360

counterintuitive the sun goes around

3322

02:02:19,750 --> 02:02:16,880

and all the other problems go around the

3323

02:02:21,589 --> 02:02:19,760

sun yeah it's brilliant idea if you want

3324

02:02:24,070 --> 02:02:21,599

right okay you get the

3325

02:02:26,310 --> 02:02:24,080

the cake and and you eat it too so you

3326

02:02:29,830 --> 02:02:26,320

get advantage of copernicus without the

3327

02:02:32,790 --> 02:02:29,840

concept of difficulty of copernicus

3328

02:02:35,430 --> 02:02:32,800

so in a sense it was to try to recover

3329

02:02:37,109 --> 02:02:35,440

the advantage of copernican staying with

3330

02:02:40,070 --> 02:02:37,119

the old

3331

02:02:41,669 --> 02:02:40,080

mind frame which is the earth is fixed

3332

02:02:44,229 --> 02:02:41,679

okay

3333

02:02:47,030 --> 02:02:44,239

is it coherent yes it's clearance has it

3334

02:02:48,870 --> 02:02:47,040

been historically useful no

3335

02:02:51,669 --> 02:02:48,880

i mean we would have never got to newton

3336

02:02:53,430 --> 02:02:51,679

or kepler or galileo and and modern

3337

02:02:56,790 --> 02:02:53,440

physics was that way

3338

02:02:59,589 --> 02:02:56,800

the point about capital was precisely

3339

02:03:01,270 --> 02:02:59,599

that if we give up this moving if we get

3340

02:03:02,629 --> 02:03:01,280

out of this

3341

02:03:04,950 --> 02:03:02,639

mind frame

3342

02:03:06,310 --> 02:03:04,960

of we are static

3343

02:03:07,510 --> 02:03:06,320

we have a better way of understanding

3344

02:03:09,669 --> 02:03:07,520

the world

3345

02:03:10,950 --> 02:03:09,679

so tico was completely wrong

3346

02:03:12,310 --> 02:03:10,960

scientifically and of course we

3347

02:03:14,470 --> 02:03:12,320

recognize it completely wrong

3348

02:03:16,470 --> 02:03:14,480

scientifically right

3349

02:03:18,310 --> 02:03:16,480

so i think that when we have learned

3350

02:03:20,950 --> 02:03:18,320

general relativity or when we learn

3351

02:03:22,390 --> 02:03:20,960

special relativity of course we can you

3352

02:03:25,109 --> 02:03:22,400

know by being

3353

02:03:27,669 --> 02:03:25,119

super smart like tico arrange thing that

3354

02:03:30,070 --> 02:03:27,679

we stay with the old conceptual thing

3355

02:03:31,910 --> 02:03:30,080

and you recover the same thing with some

3356

02:03:34,070 --> 02:03:31,920

some technicalities

3357

02:03:36,870 --> 02:03:34,080

but we don't learn more about the world

3358

02:03:39,270 --> 02:03:36,880

we just hang on yourself to

3359

02:03:40,870 --> 02:03:39,280

all thinking and don't accept the new

3360

02:03:43,350 --> 02:03:40,880

thinking which is the one that

3361

02:03:44,870 --> 02:03:43,360

allows to go faster the new thinking is

3362

02:03:47,109 --> 02:03:44,880

move forget it

3363

02:03:48,470 --> 02:03:47,119

forget this intuition that my ground is

3364

02:03:50,069 --> 02:03:48,480

not moving

3365

02:03:51,910 --> 02:03:50,079

so it's the same with this

3366

02:03:54,950 --> 02:03:51,920

reconstruction quantum mechanics for

3367

02:03:57,350 --> 02:03:54,960

underlying basically classical system i

3368

02:03:59,030 --> 02:03:57,360

don't believe that it's impossible i

3369

02:04:00,709 --> 02:03:59,040

haven't seen it yet but i

3370

02:04:01,990 --> 02:04:00,719

suppose it's possible

3371

02:04:03,990 --> 02:04:02,000

but

3372

02:04:06,470 --> 02:04:04,000

is it do we believe that this

3373

02:04:08,709 --> 02:04:06,480

pushing them ahead is telling us that

3374

02:04:11,750 --> 02:04:08,719

really really nature

3375

02:04:13,430 --> 02:04:11,760

in its the death it's like we thought

3376

02:04:15,589 --> 02:04:13,440

yesterday

3377

02:04:17,430 --> 02:04:15,599

come on nature it is death it's like we

3378

02:04:18,790 --> 02:04:17,440

think today not like we thought yes

3379

02:04:20,709 --> 02:04:18,800

there's moves

3380

02:04:21,990 --> 02:04:20,719

is this what you

3381

02:04:24,310 --> 02:04:22,000

in your mind in the back your mind

3382

02:04:27,270 --> 02:04:24,320

perhaps think of lee smolin's idea of

3383

02:04:29,270 --> 02:04:27,280

time like lee you are trying to hold on

3384

02:04:30,550 --> 02:04:29,280

yeah it's the same story it's exactly

3385

02:04:33,189 --> 02:04:30,560

the same story

3386

02:04:36,830 --> 02:04:33,199

so take the take the discovery seriously

3387

02:04:42,870 --> 02:04:40,629

when he did special relativity

3388

02:04:44,149 --> 02:04:42,880

there were this maxwell equations

3389

02:04:46,950 --> 02:04:44,159

um

3390

02:04:49,669 --> 02:04:46,960

that seemed to contradict

3391

02:04:50,629 --> 02:04:49,679

galilean relativity

3392

02:04:52,790 --> 02:04:50,639

uh

3393

02:04:54,310 --> 02:04:52,800

which one is wrong

3394

02:04:56,310 --> 02:04:54,320

einstein

3395

02:04:58,709 --> 02:04:56,320

answer is neither

3396

02:04:59,669 --> 02:04:58,719

they're both right believe the physics

3397

02:05:01,830 --> 02:04:59,679

right

3398

02:05:04,149 --> 02:05:01,840

uh and and and when i said the general

3399

02:05:05,669 --> 02:05:04,159

activity he took this idea of maxwell

3400

02:05:08,149 --> 02:05:05,679

the fields

3401

02:05:09,830 --> 02:05:08,159

and he applied to to gravity so he

3402

02:05:11,910 --> 02:05:09,840

believed the physics believe the new

3403

02:05:13,030 --> 02:05:11,920

results that work those are empirically

3404

02:05:14,709 --> 02:05:13,040

con

3405

02:05:16,629 --> 02:05:14,719

don't believe your intuition believe

3406

02:05:18,950 --> 02:05:16,639

that it works

3407

02:05:20,870 --> 02:05:18,960

what if sean carroll who is a proponent

3408

02:05:22,790 --> 02:05:20,880

of the many world says to you carlo

3409

02:05:25,270 --> 02:05:22,800

you're trying to hold you say that the

3410

02:05:27,189 --> 02:05:25,280

many worlds is distasteful because look

3411

02:05:29,030 --> 02:05:27,199

the cost yeah but you're calling it a

3412

02:05:31,189 --> 02:05:29,040

cost because you're trying to hold on to

3413

02:05:37,990 --> 02:05:31,199

something else so what if sean says that

3414

02:05:42,470 --> 02:05:39,270

um

3415

02:05:43,189 --> 02:05:42,480

i i am in a discussion with with sean on

3416

02:05:50,149 --> 02:05:43,199

on

3417

02:05:53,109 --> 02:05:50,159

uh take the many world

3418

02:05:55,270 --> 02:05:53,119

interpretations seriously he likes it

3419

02:05:56,629 --> 02:05:55,280

but he likes a particularly radical

3420

02:05:58,390 --> 02:05:56,639

version

3421

02:06:00,470 --> 02:05:58,400

of the um

3422

02:06:02,629 --> 02:06:00,480

of the latino many volunteers if it's

3423

02:06:05,589 --> 02:06:02,639

not radical enough already right

3424

02:06:08,069 --> 02:06:05,599

he yeah he he called it the mag dog he

3425

02:06:09,270 --> 02:06:08,079

called it the mad dog

3426

02:06:13,510 --> 02:06:09,280

uh

3427

02:06:16,149 --> 02:06:13,520

many world interpretation the mad dog

3428

02:06:18,709 --> 02:06:16,159

in which there is only hilbert space and

3429

02:06:21,350 --> 02:06:18,719

state and hamiltonian nothing else so

3430

02:06:22,790 --> 02:06:21,360

you want to extract everything from

3431

02:06:25,510 --> 02:06:22,800

from that

3432

02:06:29,270 --> 02:06:25,520

uh i'm i'm

3433

02:06:31,030 --> 02:06:29,280

i i'm debating that i i think it's not

3434

02:06:33,430 --> 02:06:31,040

going to work in general activity for

3435

02:06:35,589 --> 02:06:33,440

this and that reason i mean he has he

3436

02:06:37,109 --> 02:06:35,599

has an answer which is yeah you know

3437

02:06:39,189 --> 02:06:37,119

you have this terminal time i can use

3438

02:06:40,950 --> 02:06:39,199

your term of time to make it answer so

3439

02:06:43,270 --> 02:06:40,960

he's trying to use my own ideas against

3440

02:06:49,189 --> 02:06:45,669

um

3441

02:06:51,669 --> 02:06:49,199

uh what would he say uh to me well i

3442

02:06:55,189 --> 02:06:51,679

think that there is a he belongs to a

3443

02:06:59,189 --> 02:06:57,189

a group of physicists

3444

02:07:01,750 --> 02:06:59,199

that are very much in love with many

3445

02:07:03,669 --> 02:07:01,760

world because they find it very simple

3446

02:07:05,030 --> 02:07:03,679

and and straightforward it's just this

3447

02:07:08,390 --> 02:07:05,040

wave function

3448

02:07:09,270 --> 02:07:08,400

extract

3449

02:07:15,589 --> 02:07:09,280

um

3450

02:07:18,390 --> 02:07:17,510

i i never heard

3451

02:07:20,310 --> 02:07:18,400

him

3452

02:07:21,669 --> 02:07:20,320

um

3453

02:07:23,669 --> 02:07:21,679

telling me what he thinking the

3454

02:07:25,910 --> 02:07:23,679

relational interpretation is is wrong

3455

02:07:28,790 --> 02:07:25,920

because when we when we've talked with

3456

02:07:31,589 --> 02:07:28,800

um we talked about his ideas uh

3457

02:07:34,870 --> 02:07:31,599

especially his this mad dog version of

3458

02:07:37,030 --> 02:07:34,880

of evelette and i i sort of uh tried to

3459

02:07:39,510 --> 02:07:37,040

point out what what are the the the

3460

02:07:41,270 --> 02:07:39,520

technical limitations of this um

3461

02:07:44,629 --> 02:07:41,280

of this idea

3462

02:07:48,069 --> 02:07:46,550

there is some people who learned quantum

3463

02:07:51,270 --> 02:07:48,079

mechanics

3464

02:07:52,550 --> 02:07:51,280

starting from schrodinger

3465

02:07:56,390 --> 02:07:52,560

and can only think about quantum

3466

02:08:00,229 --> 02:07:58,550

the

3467

02:08:06,550 --> 02:08:00,239

quantum mechanic was not born with

3468

02:08:10,870 --> 02:08:08,550

max borgnon

3469

02:08:15,910 --> 02:08:13,430

the the gottingen

3470

02:08:19,270 --> 02:08:15,920

people in matrix mechanics before

3471

02:08:22,069 --> 02:08:19,280

schrodinger paulie dirac

3472

02:08:24,470 --> 02:08:22,079

uh and it can be thought without any

3473

02:08:25,990 --> 02:08:24,480

wave function without any uh

3474

02:08:29,270 --> 02:08:26,000

any state

3475

02:08:31,430 --> 02:08:29,280

and i think that by introducing the

3476

02:08:33,350 --> 02:08:31,440

uh the wave function

3477

02:08:35,189 --> 02:08:33,360

should even confuse things made

3478

02:08:37,750 --> 02:08:35,199

calculation easier but confused the

3479

02:08:39,750 --> 02:08:37,760

ontology the picture so everybody

3480

02:08:41,589 --> 02:08:39,760

started thinking about this wave and

3481

02:08:43,669 --> 02:08:41,599

got confused

3482

02:08:47,430 --> 02:08:43,679

um

3483

02:08:51,350 --> 02:08:49,510

sean is definitely not making the

3484

02:08:54,390 --> 02:08:51,360

mistake of

3485

02:08:56,550 --> 02:08:54,400

holding on to classical intuition

3486

02:08:58,229 --> 02:08:56,560

to the opposite i mean he he takes the

3487

02:09:00,310 --> 02:08:58,239

the schrodinger wave function very

3488

02:09:04,790 --> 02:09:00,320

seriously tried to build everything

3489

02:09:05,589 --> 02:09:04,800

from that so he's blaming me probably uh

3490

02:09:07,350 --> 02:09:05,599

what

3491

02:09:09,830 --> 02:09:07,360

i am blaming

3492

02:09:12,470 --> 02:09:09,840

wolfram and lee

3493

02:09:13,830 --> 02:09:12,480

namely that i want to stay attached to

3494

02:09:15,990 --> 02:09:13,840

classical

3495

02:09:19,030 --> 02:09:16,000

to variables having values describing

3496

02:09:21,589 --> 02:09:19,040

the world in terms of facts um

3497

02:09:22,790 --> 02:09:21,599

that's probably what he

3498

02:09:25,270 --> 02:09:22,800

he wanted to

3499

02:09:27,669 --> 02:09:25,280

he would like to blame me

3500

02:09:29,669 --> 02:09:27,679

my answer is that uh

3501

02:09:31,430 --> 02:09:29,679

i think it doesn't work to think that

3502

02:09:32,950 --> 02:09:31,440

the world is just a way function is the

3503

02:09:34,950 --> 02:09:32,960

way he would like to he would like to

3504

02:09:36,629 --> 02:09:34,960

say the way function nothing else

3505

02:09:37,910 --> 02:09:36,639

there's this vector in hilbert space and

3506

02:09:39,990 --> 02:09:37,920

nothing else

3507

02:09:43,030 --> 02:09:40,000

and i think that uh

3508

02:09:44,470 --> 02:09:43,040

vector input spaces don't give me pens

3509

02:09:48,149 --> 02:09:44,480

don't give me

3510

02:09:49,910 --> 02:09:48,159

description of the world to

3511

02:09:51,990 --> 02:09:49,920

to to have a quantum theory you need

3512

02:09:53,990 --> 02:09:52,000

much more

3513

02:09:55,589 --> 02:09:54,000

many ingredients

3514

02:09:58,470 --> 02:09:55,599

uh

3515

02:10:01,189 --> 02:09:58,480

so it's not clean the pure wave function

3516

02:10:03,109 --> 02:10:01,199

picture of the world um you need the

3517

02:10:05,589 --> 02:10:03,119

operators you need again values you need

3518

02:10:07,510 --> 02:10:05,599

again vectors you need this structure

3519

02:10:09,350 --> 02:10:07,520

and this structure he hopes to just take

3520

02:10:10,470 --> 02:10:09,360

it out from the hamiltonian

3521

02:10:12,390 --> 02:10:10,480

uh

3522

02:10:14,870 --> 02:10:12,400

but once again i have not

3523

02:10:16,870 --> 02:10:14,880

seen it happening uh

3524

02:10:17,750 --> 02:10:16,880

yet so i think that the

3525

02:10:20,870 --> 02:10:17,760

um

3526

02:10:22,709 --> 02:10:20,880

mechanics is not going to be

3527

02:10:23,589 --> 02:10:22,719

fruitful we need the algebra observance

3528

02:10:26,310 --> 02:10:23,599

quantum mechanics about

3529

02:10:28,229 --> 02:10:26,320

non-communication no computer variables

3530

02:10:30,629 --> 02:10:28,239

the core of quantum mechanics is p q

3531

02:10:32,149 --> 02:10:30,639

minus q p equal $i \hbar$

3532

02:10:34,229 --> 02:10:32,159

this is the core

3533

02:10:36,709 --> 02:10:34,239

of quantum mechanics variables don't

3534

02:10:39,430 --> 02:10:36,719

commute like an unknown would insist

3535

02:10:41,589 --> 02:10:39,440

upon is a discovery that the variables

3536

02:10:43,910 --> 02:10:41,599

we use to describe the world

3537

02:10:45,430 --> 02:10:43,920

are not always defined because they are

3538

02:10:47,990 --> 02:10:45,440

no commuting so they cannot be both

3539

02:10:49,830 --> 02:10:48,000

defined at the same time that's core

3540

02:10:51,589 --> 02:10:49,840

not the wave function now how is he

3541

02:10:53,270 --> 02:10:51,599

throwing that out by trying to put so

3542

02:10:54,870 --> 02:10:53,280

much emphasis on the wave function how

3543

02:10:56,950 --> 02:10:54,880

is he throwing out those non-commuting

3544

02:10:58,629 --> 02:10:56,960

operators oh that's the mag

3545

02:10:59,350 --> 02:10:58,639

the mother dog interpretation there are

3546

02:11:05,109 --> 02:10:59,360

no

3547

02:11:06,629 --> 02:11:05,119

at the fundamental level there's only

3548

02:11:08,830 --> 02:11:06,639

the wave function and then he says

3549

02:11:11,990 --> 02:11:10,790

hamiltonian the amazonia has some

3550

02:11:14,950 --> 02:11:12,000

structure

3551

02:11:16,550 --> 02:11:14,960

hamiltonian

3552

02:11:18,069 --> 02:11:16,560

one can

3553

02:11:20,229 --> 02:11:18,079

okay derive from the structure of the

3554

02:11:20,950 --> 02:11:20,239

comet the composition of hilbert spaces

3555

02:11:22,550 --> 02:11:20,960

in

3556

02:11:24,870 --> 02:11:22,560

subsystems

3557

02:11:26,709 --> 02:11:24,880

and is some system from the subsystem i

3558

02:11:28,550 --> 02:11:26,719

can extract something which corresponds

3559

02:11:30,790 --> 02:11:28,560

to the algebra of observables so it's a

3560

02:11:33,030 --> 02:11:30,800

very indirect way of trying to

3561

02:11:36,470 --> 02:11:33,040

extract it from the dynamics it's the

3562

02:11:41,510 --> 02:11:38,950

should give us the valuables

3563

02:11:43,189 --> 02:11:41,520

it's a long way to go

3564

02:11:44,709 --> 02:11:43,199

is there a reason that he's starting

3565

02:11:46,390 --> 02:11:44,719

he's saying that there let's imagine the

3566

02:11:47,750 --> 02:11:46,400

wave function of the universe seeing

3567

02:11:49,990 --> 02:11:47,760

quantum field theory and i'm not saying

3568

02:11:51,669 --> 02:11:50,000

anything you don't know it

3569

02:11:53,350 --> 02:11:51,679

it's like operator value it's not that

3570

02:11:55,030 --> 02:11:53,360

people say it's field but it's like a

3571

02:11:56,790 --> 02:11:55,040

strange field it's an operator valued

3572

02:11:58,470 --> 02:11:56,800

field because it's not exactly what yeah

3573

02:12:00,550 --> 02:11:58,480

the mystics say it's like all like water

3574

02:12:02,550 --> 02:12:00,560

and waves well it's like an operator

3575

02:12:04,709 --> 02:12:02,560

wave if you want to call that so why is

3576

02:12:06,550 --> 02:12:04,719

he not using why is he going why is he

3577

02:12:07,750 --> 02:12:06,560

going to qm and our q of t

3578

02:12:10,149 --> 02:12:07,760

in other words

3579

02:12:11,430 --> 02:12:10,159

like the wave function of q no no no he

3580

02:12:13,830 --> 02:12:11,440

has in mind

3581

02:12:15,750 --> 02:12:13,840

quantum field theory he has my qft but

3582

02:12:17,910 --> 02:12:15,760

but but this particular structure that

3583

02:12:18,830 --> 02:12:17,920

defined qft

3584

02:12:22,149 --> 02:12:18,840

he would

3585

02:12:25,430 --> 02:12:22,159

like to say that he's only written in

3586

02:12:30,550 --> 02:12:28,470

uh so he would not he would say that you

3587

02:12:32,550 --> 02:12:30,560

know fundamentally of the world is not

3588

02:12:33,750 --> 02:12:32,560

qft is it's a very rich structure as you

3589

02:12:35,750 --> 02:12:33,760

say there are these quantum fields which

3590

02:12:37,750 --> 02:12:35,760

are actually operated this is local

3591

02:12:38,950 --> 02:12:37,760

quantum operators it's a field of

3592

02:12:41,109 --> 02:12:38,960

operators

3593

02:12:42,629 --> 02:12:41,119

uh which commute don't commute have this

3594

02:12:45,669 --> 02:12:42,639

all this problem so you have to give all

3595

02:12:47,189 --> 02:12:45,679

this machinery to make it work

3596

02:12:49,669 --> 02:12:47,199

and this machinery the operators the

3597

02:12:51,350 --> 02:12:49,679

fields are observable so what we

3598

02:12:52,709 --> 02:12:51,360

interact describe how we interact with

3599

02:12:57,990 --> 02:12:52,719

the field right

3600

02:13:03,030 --> 02:13:00,790

he want to say there's only

3601
02:13:04,709 --> 02:13:03,040
a big guild of space a hub space is just

3602
02:13:06,069 --> 02:13:04,719
a great thing we don't require anything

3603
02:13:07,270 --> 02:13:06,079
else

3604
02:13:09,430 --> 02:13:07,280
okay

3605
02:13:10,950 --> 02:13:09,440
and it's just how the

3606
02:13:13,350 --> 02:13:10,960
what gives the motion

3607
02:13:14,390 --> 02:13:13,360
of of of of the state in the hill this

3608
02:13:16,470 --> 02:13:14,400
place

3609
02:13:18,790 --> 02:13:16,480
but he will say the hamiltonian has some

3610
02:13:20,790 --> 02:13:18,800
structure inside it because it we can

3611
02:13:23,109 --> 02:13:20,800
it's eigen values have some structure

3612
02:13:24,870 --> 02:13:23,119
some some some way of combining them and

3613
02:13:26,550 --> 02:13:24,880

we secretly know

3614

02:13:28,950 --> 02:13:26,560

about all the machinery of quantum field

3615

02:13:31,189 --> 02:13:28,960

theory

3616

02:13:34,470 --> 02:13:31,199

uh it's it's a technical step i don't

3617

02:13:37,109 --> 02:13:34,480

know if i if i need to go into that

3618

02:13:40,629 --> 02:13:38,950

but but but he has in mind quantitative

3619

02:13:42,629 --> 02:13:40,639

theory in fact the the property of the

3620

02:13:44,870 --> 02:13:42,639

hamiltonian that

3621

02:13:47,669 --> 02:13:44,880

he uses is the locality of the

3622

02:13:49,030 --> 02:13:47,679

interaction tony can be written as a

3623

02:13:50,950 --> 02:13:49,040

uh

3624

02:13:52,629 --> 02:13:50,960

and the locality gives the region of

3625

02:13:53,830 --> 02:13:52,639

space

3626

02:13:55,589 --> 02:13:53,840

uh

3627

02:14:05,750 --> 02:13:55,599

so here's this

3628

02:14:08,870 --> 02:14:07,189

many world

3629

02:14:10,470 --> 02:14:08,880

and my objection

3630

02:14:11,910 --> 02:14:10,480

is you need a hamiltonian and you don't

3631

02:14:16,550 --> 02:14:11,920

have an eternal generativity because

3632

02:14:21,830 --> 02:14:19,430

okay now what is your opinion on eric

3633

02:14:23,750 --> 02:14:21,840

weinstein's geometric unity have you had

3634

02:14:24,709 --> 02:14:23,760

a chance to go through any of the papers

3635

02:14:33,270 --> 02:14:24,719

no

3636

02:14:35,430 --> 02:14:33,280

okay that's fine how about

3637

02:14:36,870 --> 02:14:35,440

donald hoffman's have you do you know

3638

02:14:38,870 --> 02:14:36,880

donald hoffman

3639

02:14:40,390 --> 02:14:38,880

so he has

3640

02:14:45,109 --> 02:14:40,400

the case against reality and yours is

3641

02:14:50,629 --> 02:14:46,950

yes oh this is a big philosophical

3642

02:14:53,589 --> 02:14:52,470

he definitely have

3643

02:14:59,830 --> 02:14:53,599

um

3644

02:15:02,310 --> 02:14:59,840

and some

3645

02:15:04,310 --> 02:15:02,320

radical conclusions from

3646

02:15:05,510 --> 02:15:04,320

from those

3647

02:15:07,669 --> 02:15:05,520

um

3648

02:15:10,310 --> 02:15:07,679

i i know about a little bit about his

3649

02:15:12,470 --> 02:15:10,320

ideas but i have not read his book so

3650

02:15:15,750 --> 02:15:12,480

i'm not sure i have a

3651
02:15:16,709 --> 02:15:15,760
good uh gauging of exactly what you want

3652
02:15:17,990 --> 02:15:16,719
to draw

3653
02:15:19,109 --> 02:15:18,000
from that

3654
02:15:21,669 --> 02:15:19,119
um

3655
02:15:24,069 --> 02:15:21,679
but let me let me say the core of of

3656
02:15:24,870 --> 02:15:24,079
what i think um

3657
02:15:26,390 --> 02:15:24,880
we

3658
02:15:29,750 --> 02:15:26,400
interact

3659
02:15:35,430 --> 02:15:29,760
with the external world around us

3660
02:15:37,109 --> 02:15:35,440
through um our senses and to our uh um

3661
02:15:38,310 --> 02:15:37,119
the way the brain

3662
02:15:39,109 --> 02:15:38,320
interprets

3663
02:15:41,350 --> 02:15:39,119

um

3664

02:15:42,870 --> 02:15:41,360

what we see around us

3665

02:15:44,069 --> 02:15:42,880

and uh

3666

02:15:45,750 --> 02:15:44,079

i think it's

3667

02:15:48,830 --> 02:15:45,760

uh

3668

02:15:51,589 --> 02:15:48,840

a a very good and and very deep

3669

02:15:53,830 --> 02:15:51,599

observation to

3670

02:15:55,589 --> 02:15:53,840

recognize to realize that we call what

3671

02:15:57,350 --> 02:15:55,599

we call the objects

3672

02:15:59,750 --> 02:15:57,360

around us

3673

02:16:02,390 --> 02:15:59,760

are to a large extent uh

3674

02:16:03,350 --> 02:16:02,400

mental constructs

3675

02:16:05,350 --> 02:16:03,360

um

3676
02:16:06,550 --> 02:16:05,360
that uh

3677
02:16:09,350 --> 02:16:06,560
our brain

3678
02:16:10,229 --> 02:16:09,360
uh puts together

3679
02:16:12,470 --> 02:16:10,239
uh

3680
02:16:13,669 --> 02:16:12,480
on the basis of how

3681
02:16:14,470 --> 02:16:13,679
useful

3682
02:16:16,790 --> 02:16:14,480
uh

3683
02:16:19,270 --> 02:16:16,800
this construct have been in our

3684
02:16:23,109 --> 02:16:19,280
evolution to to

3685
02:16:24,310 --> 02:16:23,119
um to allow us to to survive

3686
02:16:25,270 --> 02:16:24,320
so

3687
02:16:26,550 --> 02:16:25,280
uh

3688
02:16:29,270 --> 02:16:26,560

in in

3689

02:16:31,830 --> 02:16:29,280

in a sense we're we're seeing a movie of

3690

02:16:33,830 --> 02:16:31,840

what is outside which is vaguely related

3691

02:16:35,750 --> 02:16:33,840

to what is outside whatever it's

3692

02:16:39,349 --> 02:16:35,760

happening outside

3693

02:16:43,589 --> 02:16:39,359

and is deeply um

3694

02:16:45,669 --> 02:16:43,599

colored by our reading of it um

3695

02:16:47,990 --> 02:16:45,679

this is uh this is an observation which

3696

02:16:50,389 --> 02:16:48,000

has been made in philosophy uh

3697

02:16:52,309 --> 02:16:50,399

many times in fact it's one of the main

3698

02:16:53,429 --> 02:16:52,319

uh things for which kant

3699

02:16:54,870 --> 02:16:53,439

is known

3700

02:16:56,389 --> 02:16:54,880

and kant is considered a major

3701

02:16:58,309 --> 02:16:56,399

philosopher in

3702

02:17:01,589 --> 02:16:58,319

the western tradition but

3703

02:17:02,309 --> 02:17:01,599

it's it's others others before and after

3704

02:17:06,709 --> 02:17:02,319

have

3705

02:17:09,270 --> 02:17:06,719

and i think it's important uh because

3706

02:17:10,469 --> 02:17:09,280

what we're describing at every level is

3707

02:17:14,549 --> 02:17:10,479

not the world it's a world of

3708

02:17:15,429 --> 02:17:14,559

perspective it's a world aspect

3709

02:17:17,669 --> 02:17:15,439

um

3710

02:17:19,509 --> 02:17:17,679

and i think this this has to be deeply

3711

02:17:21,270 --> 02:17:19,519

into your eyes even if it seems so what

3712

02:17:23,110 --> 02:17:21,280

what has the natural reaction of that i

3713

02:17:24,870 --> 02:17:23,120

mean there's a chair there and of course

3714

02:17:26,549 --> 02:17:24,880

i mean i am saying well come on the

3715

02:17:28,070 --> 02:17:26,559

chair is there independently for me and

3716

02:17:29,270 --> 02:17:28,080

there is a sense in which this is not

3717

02:17:31,509 --> 02:17:29,280

true

3718

02:17:33,270 --> 02:17:31,519

the chair is my particular reading of

3719

02:17:34,150 --> 02:17:33,280

what is going on for a number of reasons

3720

02:17:36,389 --> 02:17:34,160

for a

3721

02:17:38,870 --> 02:17:36,399

variety of reasons that he he goes in

3722

02:17:40,870 --> 02:17:38,880

details in the very right

3723

02:17:43,429 --> 02:17:40,880

so the disagreement is

3724

02:17:44,389 --> 02:17:43,439

now so far i'm i'm completely with him

3725

02:17:46,150 --> 02:17:44,399

uh

3726

02:17:48,309 --> 02:17:46,160

now the two points

3727

02:17:49,750 --> 02:17:48,319

one is that all right so

3728

02:17:51,830 --> 02:17:49,760

what

3729

02:17:53,110 --> 02:17:51,840

um

3730

02:17:55,270 --> 02:17:53,120

then what

3731

02:17:57,429 --> 02:17:55,280

um

3732

02:17:59,750 --> 02:17:57,439

and there are two points i would uh not

3733

02:18:02,309 --> 02:17:59,760

really object but i would

3734

02:18:04,389 --> 02:18:02,319

say how i think about this first of all

3735

02:18:07,349 --> 02:18:04,399

that this does not mean

3736

02:18:09,030 --> 02:18:07,359

that our mental world

3737

02:18:12,309 --> 02:18:09,040

is more

3738

02:18:15,589 --> 02:18:12,319

solid and known that the external

3739

02:18:18,549 --> 02:18:15,599

because exactly the same arguments

3740

02:18:20,870 --> 02:18:18,559

uh employed here for the external world

3741

02:18:23,349 --> 02:18:20,880

exactly the same arguments work for our

3742

02:18:26,950 --> 02:18:23,359

mental world namely

3743

02:18:29,750 --> 02:18:26,960

there is nothing certain either

3744

02:18:32,469 --> 02:18:29,760

in what we see as our sense of our self

3745

02:18:34,230 --> 02:18:32,479

our perception these are also

3746

02:18:36,070 --> 02:18:34,240

complicated the

3747

02:18:39,190 --> 02:18:36,080

uh

3748

02:18:41,589 --> 02:18:39,200

cultural biological construction

3749

02:18:43,270 --> 02:18:41,599

that our representation of the world

3750

02:18:45,750 --> 02:18:43,280

has so our reputation for the world

3751

02:18:48,549 --> 02:18:45,760

include a notion of myself and also my

3752

02:18:49,990 --> 02:18:48,559

representations also my representations

3753

02:18:52,709 --> 02:18:50,000

which are all notions that were

3754

02:18:55,190 --> 02:18:52,719

developed culturally

3755

02:18:58,070 --> 02:18:55,200

so the same criticism

3756

02:18:59,589 --> 02:18:58,080

against the existence of outside objects

3757

02:19:01,990 --> 02:18:59,599

i think hold

3758

02:19:03,669 --> 02:19:02,000

for the existence of

3759

02:19:06,870 --> 02:19:03,679

the self

3760

02:19:08,629 --> 02:19:06,880

uh and my mental world

3761

02:19:11,750 --> 02:19:08,639

okay

3762

02:19:15,910 --> 02:19:11,760

so this leaves us where

3763

02:19:18,549 --> 02:19:15,920

i think and this is my my arrival point

3764

02:19:20,629 --> 02:19:18,559

this leaves us in my opinion

3765

02:19:23,750 --> 02:19:20,639

towards

3766

02:19:25,990 --> 02:19:23,760

the anti-foundationalism

3767

02:19:27,270 --> 02:19:26,000

that we talked at the beginning of the

3768

02:19:29,270 --> 02:19:27,280

story

3769

02:19:32,150 --> 02:19:29,280

namely we should not ask the wrong

3770

02:19:35,270 --> 02:19:32,160

question the wrong question is what is

3771

02:19:36,950 --> 02:19:35,280

really really really outside there

3772

02:19:38,790 --> 02:19:36,960

that's a wrong question

3773

02:19:39,750 --> 02:19:38,800

the right question

3774

02:19:40,220 --> 02:19:39,760

is

3775

02:19:41,750 --> 02:19:40,230

um

3776

02:19:43,589 --> 02:19:41,760

[Music]

3777

02:19:44,709 --> 02:19:43,599

i see

3778

02:19:45,830 --> 02:19:44,719

a mirror

3779

02:19:48,549 --> 02:19:45,840

okay

3780

02:19:50,070 --> 02:19:48,559

it seems to me that a chair is the other

3781

02:19:52,070 --> 02:19:50,080

side of the mirror

3782

02:19:53,670 --> 02:19:52,080

is it true or false no it's false is an

3783

02:19:56,150 --> 02:19:53,680

illusion the chair is not the other side

3784

02:19:57,830 --> 02:19:56,160

of the mirror the chair is here

3785

02:20:00,469 --> 02:19:57,840

okay

3786

02:20:03,750 --> 02:20:00,479

the chair is really here and falsely

3787

02:20:05,429 --> 02:20:03,760

outside the mirror that's correct

3788

02:20:07,990 --> 02:20:05,439

okay

3789

02:20:09,910 --> 02:20:08,000

we can play this game step by step

3790

02:20:11,990 --> 02:20:09,920

by realizing that things are not like

3791

02:20:13,429 --> 02:20:12,000

that we're misunderstanding there

3792

02:20:15,190 --> 02:20:13,439

there's a better way of understanding

3793

02:20:17,110 --> 02:20:15,200

that they're not like that the

3794

02:20:18,790 --> 02:20:17,120

misunderstanding there's a matter with

3795

02:20:21,309 --> 02:20:18,800

if we ask the question okay so what is

3796

02:20:22,870 --> 02:20:21,319

the ultimate reality

3797

02:20:25,270 --> 02:20:22,880

independently

3798

02:20:28,309 --> 02:20:25,280

of any representation that's not a good

3799

02:20:31,510 --> 02:20:28,319

question in my opinion

3800

02:20:34,950 --> 02:20:31,520

that's a wrong question reality is that

3801

02:20:37,030 --> 02:20:34,960

chair reality is that son the reality is

3802

02:20:39,110 --> 02:20:37,040

that sharing the mural

3803

02:20:40,230 --> 02:20:39,120

and their relations their relative

3804

02:20:42,870 --> 02:20:40,240

relations

3805

02:20:44,469 --> 02:20:42,880

so i will jump out of this discussion

3806

02:20:46,950 --> 02:20:44,479

okay and

3807

02:20:48,790 --> 02:20:46,960

distinguish if you want the apparent

3808

02:20:50,950 --> 02:20:48,800

reality and the ultimate reality and

3809

02:20:52,950 --> 02:20:50,960

forget about the ultimate reality we are

3810

02:20:55,349 --> 02:20:52,960

talking about this after reality and

3811

02:20:57,590 --> 02:20:55,359

that's what we call reality

3812

02:21:00,870 --> 02:20:57,600

reality is the ensemble

3813

02:21:03,110 --> 02:21:00,880

of this phenomena of which i am part and

3814

02:21:04,950 --> 02:21:03,120

your part and the cherries part

3815

02:21:07,110 --> 02:21:04,960

and all the way we

3816

02:21:09,270 --> 02:21:07,120

understand better and better and better

3817

02:21:12,469 --> 02:21:09,280

we can say they are made by atoms for

3818

02:21:14,469 --> 02:21:12,479

fantastic we can say the atoms are a

3819

02:21:17,110 --> 02:21:14,479

quantum mechanical object that interact

3820

02:21:18,150 --> 02:21:17,120

with us fantastic we we get more and

3821

02:21:20,870 --> 02:21:18,160

more

3822

02:21:22,150 --> 02:21:20,880

complexity of the phenomena

3823

02:21:24,870 --> 02:21:22,160

but we

3824

02:21:28,070 --> 02:21:24,880

if we get if we ask the question

3825

02:21:30,870 --> 02:21:28,080

where do we ground all that what is the

3826

02:21:33,910 --> 02:21:30,880

ultimate reality forget about this so if

3827

02:21:35,910 --> 02:21:33,920

the case against reality

3828

02:21:38,389 --> 02:21:35,920

that he's making

3829

02:21:41,429 --> 02:21:38,399

is the case is the case against the idea

3830

02:21:43,830 --> 02:21:41,439

of an ultimate reality out there

3831

02:21:44,790 --> 02:21:43,840

and in favor of an ultimate reality for

3832

02:21:47,670 --> 02:21:44,800

our

3833

02:21:49,349 --> 02:21:47,680

impressions i disagree

3834

02:21:51,910 --> 02:21:49,359

because there is a good way of

3835

02:21:55,910 --> 02:21:51,920

understanding our impression as caused

3836

02:21:56,950 --> 02:21:55,920

by the chair that chair

3837

02:21:59,030 --> 02:21:56,960

not

3838

02:22:01,190 --> 02:21:59,040

a metaphysical chair

3839

02:22:03,670 --> 02:22:01,200

or if you want in kantian terms who

3840

02:22:05,830 --> 02:22:03,680

cares about the aluminum we care about

3841

02:22:07,910 --> 02:22:05,840

the phenomena

3842

02:22:08,710 --> 02:22:07,920

what we call reality is a phenomena not

3843

02:22:10,550 --> 02:22:08,720

an

3844

02:22:13,830 --> 02:22:10,560

hypothetical thing

3845

02:22:15,349 --> 02:22:13,840

behind the phenomena

3846

02:22:16,630 --> 02:22:15,359

that's my take on it

3847

02:22:19,510 --> 02:22:16,640

when i hear that well here's what i'm

3848

02:22:21,190 --> 02:22:19,520

thinking okay you said the chair is not

3849

02:22:24,150 --> 02:22:21,200

really behind the mirror it's really

3850

02:22:25,990 --> 02:22:24,160

over to the left of me okay yeah

3851

02:22:27,429 --> 02:22:26,000

and that's what it means really

3852

02:22:29,510 --> 02:22:27,439

right we have this notion of really we

3853

02:22:32,070 --> 02:22:29,520

have this notion of reality then if i

3854

02:22:34,309 --> 02:22:32,080

was to get you or anyone else just say

3855

02:22:37,030 --> 02:22:34,319

people in general to what are some facts

3856

02:22:38,790 --> 02:22:37,040

that of what is a part of reality see

3857

02:22:40,230 --> 02:22:38,800

we're trying to derive a definition from

3858

02:22:42,550 --> 02:22:40,240

looking at well i say that this

3859

02:22:44,870 --> 02:22:42,560

microphone is really in front of me and

3860

02:22:47,190 --> 02:22:44,880

then i may point to other objects

3861

02:22:49,349 --> 02:22:47,200

and say that really is the case but then

3862

02:22:51,110 --> 02:22:49,359

well what if there's an inconsistency in

3863

02:22:54,870 --> 02:22:51,120

what we call a part of our reality and

3864

02:22:57,030 --> 02:22:54,880

not then which one do we take as more

3865

02:22:58,710 --> 02:22:57,040

why do we favor this microphone being

3866

02:23:00,469 --> 02:22:58,720

really in front of me but

3867

02:23:03,190 --> 02:23:00,479

santa claus not really existing no you

3868

02:23:05,910 --> 02:23:03,200

have you have i got exactly the point i

3869

02:23:08,230 --> 02:23:05,920

think we have to use really

3870

02:23:10,870 --> 02:23:08,240

coherence just which ones mix cohere

3871

02:23:14,230 --> 02:23:10,880

together consistent what is it

3872

02:23:17,429 --> 02:23:14,240

i i think we have to realize that uh

3873

02:23:20,630 --> 02:23:17,439

really in reality

3874

02:23:22,469 --> 02:23:20,640

it's uh uh it can be used in different

3875

02:23:24,230 --> 02:23:22,479

uh right right right do use at different

3876

02:23:28,750 --> 02:23:24,240

levels and it's fine we do different

3877

02:23:33,670 --> 02:23:30,830

did

3878

02:23:35,750 --> 02:23:33,680

uh um hamlet

3879

02:23:38,630 --> 02:23:35,760

really killed his uncle

3880

02:23:41,110 --> 02:23:38,640

yes he did really kill his uncle i mean

3881

02:23:42,870 --> 02:23:41,120

um if you tell me you know hamlet did

3882

02:23:45,110 --> 02:23:42,880

not kill his uncle at the end of the

3883

02:23:47,349 --> 02:23:45,120

play i said no no he did he really did

3884

02:23:49,510 --> 02:23:47,359

look i come with shakespeare texts i

3885

02:23:51,510 --> 02:23:49,520

said it's written here i'm killing you

3886

02:23:53,670 --> 02:23:51,520

uncle okay

3887

02:23:55,030 --> 02:23:53,680

so i'm using really

3888

02:23:58,870 --> 02:23:55,040

okay

3889

02:24:00,550 --> 02:23:58,880

and now you tell me come on it's not

3890

02:24:01,750 --> 02:24:00,560

real because it's a play of course it's

3891

02:24:02,550 --> 02:24:01,760

not real

3892

02:24:04,309 --> 02:24:02,560

okay

3893

02:24:05,830 --> 02:24:04,319

so when am i right when i say i'm real

3894

02:24:07,349 --> 02:24:05,840

what i'm saying unboxed right in both

3895

02:24:11,349 --> 02:24:07,359

cases i'm just meaning two different

3896

02:24:13,270 --> 02:24:11,359

views so real is in a context

3897

02:24:15,349 --> 02:24:13,280

if you want to take a real outside the

3898

02:24:16,389 --> 02:24:15,359

questions what is really really really

3899

02:24:18,870 --> 02:24:16,399

real

3900

02:24:22,389 --> 02:24:18,880

behind all the context

3901
02:24:26,950 --> 02:24:24,790
so talking about the mirror we make a

3902
02:24:29,349 --> 02:24:26,960
distinction between the chair and the

3903
02:24:31,590 --> 02:24:29,359
other side of the mirror and the chair

3904
02:24:33,590 --> 02:24:31,600
that chair there

3905
02:24:45,030 --> 02:24:33,600
and

3906
02:24:46,550 --> 02:24:45,040
i mean i i mean if i walk against the

3907
02:24:48,150 --> 02:24:46,560
mirror i just

3908
02:24:50,230 --> 02:24:48,160
hit my nose against them

3909
02:24:51,830 --> 02:24:50,240
while if i walk there that chair i can

3910
02:24:53,349 --> 02:24:51,840
see down i mean just

3911
02:24:55,190 --> 02:24:53,359
there's a very precise sense in which

3912
02:24:58,710 --> 02:24:55,200
one is more real than the other

3913
02:25:00,469 --> 02:24:58,720

okay and in the in if i'm dreaming

3914

02:25:03,429 --> 02:25:00,479

there's a very precise sense in which i

3915

02:25:04,309 --> 02:25:03,439

say that's not real it was a dream

3916

02:25:06,150 --> 02:25:04,319

okay

3917

02:25:08,150 --> 02:25:06,160

but within the dream itself there i

3918

02:25:10,950 --> 02:25:08,160

think which are real in the dream and

3919

02:25:12,950 --> 02:25:10,960

not real in the dream okay in the dream

3920

02:25:15,190 --> 02:25:12,960

i can dream of somebody who is telling

3921

02:25:16,950 --> 02:25:15,200

me uh i mean look you thought that is so

3922

02:25:18,550 --> 02:25:16,960

bad is not so they reveal something else

3923

02:25:20,550 --> 02:25:18,560

so within the dream there is a notion of

3924

02:25:23,670 --> 02:25:20,560

reality there in the movie there is a

3925

02:25:25,110 --> 02:25:23,680

notion of reality there

3926

02:25:26,710 --> 02:25:25,120

so

3927

02:25:29,110 --> 02:25:26,720

the question what is real is a very

3928

02:25:32,150 --> 02:25:29,120

slippery question it's a

3929

02:25:34,550 --> 02:25:32,160

context by context it makes sense

3930

02:25:35,510 --> 02:25:34,560

but every time we see a context

3931

02:25:37,030 --> 02:25:35,520

in which

3932

02:25:39,110 --> 02:25:37,040

we're giving something for granted and

3933

02:25:40,870 --> 02:25:39,120

we're building them

3934

02:25:43,910 --> 02:25:40,880

and when

3935

02:25:45,510 --> 02:25:43,920

when i hear the argument

3936

02:25:46,550 --> 02:25:45,520

um

3937

02:25:49,270 --> 02:25:46,560

look

3938

02:25:56,710 --> 02:25:50,630

the

3939

02:25:59,349 --> 02:25:56,720

makes sense of that chair it's because

3940

02:26:01,190 --> 02:25:59,359

in my brain there is a notion of sitting

3941

02:26:04,150 --> 02:26:01,200

there is an ocean because there is a

3942

02:26:04,830 --> 02:26:04,160

space of colors blah blah blah blah

3943

02:26:07,830 --> 02:26:04,840

and

3944

02:26:09,510 --> 02:26:07,840

therefore uh the chair it's it's it's

3945

02:26:11,190 --> 02:26:09,520

it's it's really a cherry

3946

02:26:13,990 --> 02:26:11,200

in an illusion for me

3947

02:26:16,550 --> 02:26:14,000

the context is a context in which i'm

3948

02:26:18,870 --> 02:26:16,560

giving for real a number of things my

3949

02:26:22,790 --> 02:26:18,880

brain

3950

02:26:25,270 --> 02:26:22,800

the the the the the more the the the the

3951
02:26:27,190 --> 02:26:25,280
the the existence of light coming to me

3952
02:26:29,110 --> 02:26:27,200
you you're creating a context so that

3953
02:26:33,030 --> 02:26:29,120
within that context there's a notion of

3954
02:26:34,870 --> 02:26:33,040
reality and and and and illusion

3955
02:26:37,510 --> 02:26:34,880
and what about that context itself is it

3956
02:26:38,309 --> 02:26:37,520
real is not real

3957
02:26:40,790 --> 02:26:38,319
it's

3958
02:26:42,550 --> 02:26:40,800
i i think that we describe the phenomena

3959
02:26:44,630 --> 02:26:42,560
that we interact with

3960
02:26:46,870 --> 02:26:44,640
and within description that's the

3961
02:26:48,469 --> 02:26:46,880
scripture is reality that's what we mean

3962
02:26:50,870 --> 02:26:48,479
by reality

3963
02:26:51,910 --> 02:26:50,880

and if we try to say

3964

02:26:53,830 --> 02:26:51,920

uh

3965

02:26:56,230 --> 02:26:53,840

beyond the phenomena

3966

02:26:58,550 --> 02:26:56,240

what is the true ultimate reality we're

3967

02:27:00,309 --> 02:26:58,560

making a mistake

3968

02:27:02,790 --> 02:27:00,319

and this is a mistake

3969

02:27:05,510 --> 02:27:02,800

that a lot of philosophers

3970

02:27:10,389 --> 02:27:05,520

have warned us against many

3971

02:27:15,670 --> 02:27:12,790

a lot of phenomenal say careful

3972

02:27:17,510 --> 02:27:15,680

i mean you take a distinction

3973

02:27:19,670 --> 02:27:17,520

the chair in the mirror and and the

3974

02:27:21,030 --> 02:27:19,680

chair you see there and you're trying to

3975

02:27:22,309 --> 02:27:21,040

replay that

3976

02:27:23,830 --> 02:27:22,319

that's everything you know about the

3977

02:27:25,990 --> 02:27:23,840

universe and something else which is a

3978

02:27:28,309 --> 02:27:26,000

real real real thing that's a real real

3979

02:27:30,230 --> 02:27:28,319

thing forget about it don't don't do

3980

02:27:31,750 --> 02:27:30,240

that

3981

02:27:32,870 --> 02:27:31,760

so i would say

3982

02:27:35,510 --> 02:27:32,880

that

3983

02:27:39,429 --> 02:27:35,520

we don't have a case against reality

3984

02:27:40,870 --> 02:27:39,439

with a case for reality

3985

02:27:42,710 --> 02:27:40,880

and against the idea that there's an

3986

02:27:45,990 --> 02:27:42,720

ultimate reality behind it beyond

3987

02:27:49,750 --> 02:27:47,590

when you say that what i'm wondering is

3988

02:27:52,070 --> 02:27:49,760

is that because we can never know what's

3989

02:27:54,230 --> 02:27:52,080

outside of what's knowable so you gave

3990

02:27:55,910 --> 02:27:54,240

kant the phenomenon the pneumonia give

3991

02:27:58,550 --> 02:27:55,920

that example is it because of that we

3992

02:28:00,070 --> 02:27:58,560

can just not know it why is it that

3993

02:28:03,349 --> 02:28:00,080

it's so foolish to talk about the

3994

02:28:05,830 --> 02:28:04,230

uh

3995

02:28:07,750 --> 02:28:05,840

to the extent in which we can know

3996

02:28:10,230 --> 02:28:07,760

something else we may hope to know

3997

02:28:12,630 --> 02:28:10,240

something else we we correctly

3998

02:28:14,550 --> 02:28:12,640

put this question

3999

02:28:15,750 --> 02:28:14,560

uh on the table

4000

02:28:18,550 --> 02:28:15,760

right

4001
02:28:20,150 --> 02:28:18,560
uh but only to the extent in which we

4002
02:28:22,710 --> 02:28:20,160
may have a hope

4003
02:28:23,750 --> 02:28:22,720
to know something else

4004
02:28:25,110 --> 02:28:23,760
um

4005
02:28:27,590 --> 02:28:25,120
i'll explain my reasoning behind the

4006
02:28:28,950 --> 02:28:27,600
question and me so when i'm speaking to

4007
02:28:31,190 --> 02:28:28,960
some non-dualist i don't know if you

4008
02:28:33,110 --> 02:28:31,200
know what non-dualism is

4009
02:28:34,870 --> 02:28:33,120
they would say consciousness is primary

4010
02:28:36,309 --> 02:28:34,880
and then i pose the question well how do

4011
02:28:38,309 --> 02:28:36,319
you know what if there's something

4012
02:28:39,590 --> 02:28:38,319
outside consciousness a simple question

4013
02:28:40,790 --> 02:28:39,600

they would say yeah but you could never

4014

02:28:41,910 --> 02:28:40,800

know that

4015

02:28:43,510 --> 02:28:41,920

well

4016

02:28:46,630 --> 02:28:43,520

it's true i can't experience what's

4017

02:28:47,990 --> 02:28:46,640

outside my experience by definition

4018

02:28:50,790 --> 02:28:48,000

but that to me doesn't mean that it

4019

02:28:52,389 --> 02:28:50,800

doesn't exist now you one can say that

4020

02:28:53,910 --> 02:28:52,399

it's foolish to talk about it because it

4021

02:28:56,230 --> 02:28:53,920

never interacts with you and you have no

4022

02:28:58,389 --> 02:28:56,240

clue that's another argument but to say

4023

02:29:00,469 --> 02:28:58,399

it doesn't exist

4024

02:29:03,270 --> 02:29:00,479

because it's outside of our experience i

4025

02:29:07,030 --> 02:29:03,280

don't find that particularly convincing

4026
02:29:09,030 --> 02:29:07,040
so that's what's behind my question

4027
02:29:12,150 --> 02:29:09,040
no no it's it's it's it's a good

4028
02:29:18,630 --> 02:29:12,160
question uh i i i see the point

4029
02:29:18,640 --> 02:29:24,230
we

4030
02:29:27,270 --> 02:29:25,990
what is the use

4031
02:29:30,790 --> 02:29:27,280
of

4032
02:29:32,550 --> 02:29:30,800
that there is something beyond our

4033
02:29:35,590 --> 02:29:32,560
knowledge

4034
02:29:36,950 --> 02:29:35,600
okay i think there are two uses

4035
02:29:41,910 --> 02:29:36,960
one is that

4036
02:29:45,110 --> 02:29:42,710
and

4037
02:29:45,830 --> 02:29:45,120
the other is just you know to recognize

4038
02:29:49,670 --> 02:29:45,840

that

4039

02:29:51,110 --> 02:29:49,680

be something

4040

02:29:54,230 --> 02:29:51,120

and

4041

02:29:55,190 --> 02:29:54,240

these are two very different situations

4042

02:30:00,870 --> 02:29:55,200

uh

4043

02:30:03,110 --> 02:30:00,880

if if i see a chair and i suspect that

4044

02:30:06,070 --> 02:30:03,120

it might be in understandable in terms

4045

02:30:09,990 --> 02:30:07,429

i can

4046

02:30:11,910 --> 02:30:10,000

ask the question uh

4047

02:30:15,270 --> 02:30:11,920

maybe beyond the appearance of the chair

4048

02:30:16,870 --> 02:30:15,280

there is a atomic structure

4049

02:30:18,870 --> 02:30:16,880

and then i can do some science or i can

4050

02:30:20,870 --> 02:30:18,880

do some investigation or can do b

4051
02:30:23,910 --> 02:30:20,880
boltzmann and come up with explanation

4052
02:30:26,389 --> 02:30:23,920
of temperature on the basis of that

4053
02:30:29,030 --> 02:30:26,399
or be einstein and come up with a brown

4054
02:30:31,510 --> 02:30:29,040
emotion and from the atoms explained by

4055
02:30:34,550 --> 02:30:31,520
an emotion or then you know be ibm that

4056
02:30:36,070 --> 02:30:34,560
make a microscope and see the atoms

4057
02:30:42,630 --> 02:30:36,080
so

4058
02:30:45,590 --> 02:30:42,640
a better deeper

4059
02:30:48,550 --> 02:30:45,600
um description reality and that allowed

4060
02:30:49,349 --> 02:30:48,560
me to get a better escape from the world

4061
02:30:53,110 --> 02:30:49,359
that's

4062
02:30:54,389 --> 02:30:53,120
it's a situation in which is good to say

4063
02:30:56,630 --> 02:30:54,399

well

4064

02:30:58,710 --> 02:30:56,640

maybe i just don't know something which

4065

02:31:01,670 --> 02:30:58,720

i might know it

4066

02:31:02,550 --> 02:31:01,680

but if the argument

4067

02:31:04,870 --> 02:31:02,560

uh

4068

02:31:06,710 --> 02:31:04,880

like the case against reality is that

4069

02:31:08,070 --> 02:31:06,720

there is a reality which is in principle

4070

02:31:10,790 --> 02:31:08,080

unknowable

4071

02:31:13,750 --> 02:31:10,800

that they cannot know about that

4072

02:31:17,030 --> 02:31:13,760

which is a completely different story is

4073

02:31:22,870 --> 02:31:19,750

maybe there is an aspect of

4074

02:31:24,309 --> 02:31:22,880

beyond what we call reality usually

4075

02:31:27,270 --> 02:31:24,319

which is

4076

02:31:29,030 --> 02:31:27,280

in principle and accessible

4077

02:31:30,550 --> 02:31:29,040

and then what interest do we have on

4078

02:31:32,790 --> 02:31:30,560

that on that

4079

02:31:35,429 --> 02:31:32,800

i mean why should we talk about that

4080

02:31:37,429 --> 02:31:35,439

i mean suppose uh you know i come to you

4081

02:31:38,950 --> 02:31:37,439

and say you know i believe that this is

4082

02:31:40,790 --> 02:31:38,960

a universe but there's a next to another

4083

02:31:43,510 --> 02:31:40,800

direct dimension where there are you

4084

02:31:45,510 --> 02:31:43,520

know green dragons going around and

4085

02:31:46,870 --> 02:31:45,520

speaking chinese to one another okay but

4086

02:31:48,309 --> 02:31:46,880

they never interact with us we never

4087

02:31:49,590 --> 02:31:48,319

interact with them

4088

02:31:51,750 --> 02:31:49,600

and uh

4089

02:31:53,429 --> 02:31:51,760

and they just totally

4090

02:31:55,670 --> 02:31:53,439

and then you say how do you know about

4091

02:31:57,830 --> 02:31:55,680

that i mean i don't but can you disprove

4092

02:32:01,190 --> 02:31:57,840

it no i cannot disprove it but what's

4093

02:32:02,950 --> 02:32:01,200

the interest of this story zero

4094

02:32:05,030 --> 02:32:02,960

so i think that ultimate reality is like

4095

02:32:06,550 --> 02:32:05,040

the dragons

4096

02:32:10,070 --> 02:32:06,560

speaking chinese to one another and

4097

02:32:13,429 --> 02:32:10,080

playing football in another dimension

4098

02:32:18,630 --> 02:32:16,870

by reality we mean what we interact with

4099

02:32:20,790 --> 02:32:18,640

with the complexity

4100

02:32:22,830 --> 02:32:20,800

of the different layers

4101
02:32:25,510 --> 02:32:22,840
and we may find other layers

4102
02:32:29,910 --> 02:32:25,520
perfectly but we shouldn't worry about

4103
02:32:33,670 --> 02:32:32,309
not being the totality of things

4104
02:32:36,870 --> 02:32:33,680
because that's the totality of things

4105
02:32:40,550 --> 02:32:38,630
here's what i think of when i hear that

4106
02:32:41,750 --> 02:32:40,560
again the word pragmatism comes up

4107
02:32:44,710 --> 02:32:41,760
because you're talking about well what's

4108
02:32:47,030 --> 02:32:44,720
the use of it what's the point of it

4109
02:32:49,030 --> 02:32:47,040
so then i'm wondering well is

4110
02:32:50,710 --> 02:32:49,040
is reality or theorizing tied to

4111
02:32:51,910 --> 02:32:50,720
pragmatism in some sense yes because

4112
02:32:54,230 --> 02:32:51,920
we're finite beings we have to choose to

4113
02:32:56,309 --> 02:32:54,240

do something but then

4114

02:32:58,950 --> 02:32:56,319

can we not philosophize for the sake of

4115

02:33:01,349 --> 02:32:58,960

philosophizing so that's what occurs to

4116

02:33:02,950 --> 02:33:01,359

me and then at the same time when saying

4117

02:33:04,710 --> 02:33:02,960

well we don't know if these chinese

4118

02:33:06,070 --> 02:33:04,720

dragons are playing football in some

4119

02:33:06,950 --> 02:33:06,080

other dimension that never interacts

4120

02:33:09,110 --> 02:33:06,960

with us

4121

02:33:10,870 --> 02:33:09,120

however i would say it's still firstly

4122

02:33:14,870 --> 02:33:10,880

it's fun to think about chinese football

4123

02:33:17,429 --> 02:33:16,389

just like we were talking about in the

4124

02:33:19,349 --> 02:33:17,439

beginning

4125

02:33:20,790 --> 02:33:19,359

scientists have an aversion or generally

4126
02:33:23,030 --> 02:33:20,800
now contemporary scientists have an

4127
02:33:24,550 --> 02:33:23,040
aversion to philosophizing

4128
02:33:25,910 --> 02:33:24,560
they would say well this is much of what

4129
02:33:28,389 --> 02:33:25,920
you're talking about especially when it

4130
02:33:29,910 --> 02:33:28,399
comes to metaphysics is unfalsifiable

4131
02:33:31,670 --> 02:33:29,920
science is a methodology let's apply

4132
02:33:33,670 --> 02:33:31,680
that let's stick to our mathematics but

4133
02:33:35,110 --> 02:33:33,680
then you were making the great argument

4134
02:33:37,030 --> 02:33:35,120
which is

4135
02:33:39,030 --> 02:33:37,040
that leads us to plenty of places even

4136
02:33:40,950 --> 02:33:39,040
if it seems misleading at first or even

4137
02:33:41,990 --> 02:33:40,960
if it seems to not interact with us

4138
02:33:43,910 --> 02:33:42,000

first

4139

02:33:45,990 --> 02:33:43,920

so that's what else i think about it is

4140

02:33:47,429 --> 02:33:46,000

that okay even if we say there are these

4141

02:33:48,469 --> 02:33:47,439

non-interacting

4142

02:33:51,110 --> 02:33:48,479

chinese

4143

02:33:53,429 --> 02:33:51,120

dragons that play football

4144

02:33:54,950 --> 02:33:53,439

okay let me hear you out do you truly

4145

02:33:56,790 --> 02:33:54,960

believe that do you have some

4146

02:33:58,230 --> 02:33:56,800

great arguments for it let's hear it

4147

02:33:59,910 --> 02:33:58,240

okay let's think about that would this

4148

02:34:02,469 --> 02:33:59,920

be the case of that and then you can

4149

02:34:04,550 --> 02:34:02,479

arrive someplace interesting so i'd say

4150

02:34:05,830 --> 02:34:04,560

first you said it's about a point what

4151
02:34:07,750 --> 02:34:05,840
is the point what is the use then i say

4152
02:34:09,429 --> 02:34:07,760
well that's pragmatist that's pragmatism

4153
02:34:11,270 --> 02:34:09,439
in this sense of it has to have a use to

4154
02:34:12,710 --> 02:34:11,280
us and i'm saying well we could talk

4155
02:34:14,150 --> 02:34:12,720
about that but then also at the same

4156
02:34:15,590 --> 02:34:14,160
time there could be a use in the sense

4157
02:34:17,750 --> 02:34:15,600
that well we can talk about

4158
02:34:19,830 --> 02:34:17,760
incomprehensible unfalsifiable notions

4159
02:34:21,510 --> 02:34:19,840
and still lead us somewhere propitious

4160
02:34:23,990 --> 02:34:21,520
in the long run okay so that's what i

4161
02:34:25,510 --> 02:34:24,000
think now i say that and i'm curious

4162
02:34:27,990 --> 02:34:25,520
what are your thoughts on what i've just

4163
02:34:34,469 --> 02:34:31,190

well i i wouldn't not disagree with you

4164

02:34:38,389 --> 02:34:35,830

i think there is a

4165

02:34:40,550 --> 02:34:38,399

tradition in philosophy

4166

02:34:42,950 --> 02:34:40,560

so let me develop something i hinted

4167

02:34:45,830 --> 02:34:42,960

before there's a tradition in philosophy

4168

02:34:48,309 --> 02:34:45,840

which is to warn

4169

02:34:50,790 --> 02:34:48,319

philosophy as a cure witkinstein is a

4170

02:34:53,030 --> 02:34:50,800

master of that cure against wrong

4171

02:34:55,910 --> 02:34:53,040

questions

4172

02:34:58,150 --> 02:34:55,920

we're wrong what does wrong mean here

4173

02:35:01,190 --> 02:34:58,160

uh you probably call me a pragmatist if

4174

02:35:02,389 --> 02:35:01,200

you say wrong means useless um

4175

02:35:03,910 --> 02:35:02,399

so

4176

02:35:05,990 --> 02:35:03,920

uh

4177

02:35:09,429 --> 02:35:06,000

like not good for us ultimately leads us

4178

02:35:14,309 --> 02:35:10,309

um

4179

02:35:18,630 --> 02:35:14,319

yeah so just take us to the wrong

4180

02:35:23,349 --> 02:35:21,110

if if you stay in science science was

4181

02:35:27,429 --> 02:35:23,359

often liberated

4182

02:35:30,230 --> 02:35:27,439

uh by philosophical thinking that

4183

02:35:32,550 --> 02:35:30,240

science often made step ahead

4184

02:35:34,550 --> 02:35:32,560

by getting input from philosophy that

4185

02:35:38,230 --> 02:35:34,560

said well you don't you don't have to

4186

02:35:41,270 --> 02:35:39,510

certainly

4187

02:35:42,710 --> 02:35:41,280

this played around

4188

02:35:45,349 --> 02:35:42,720

copernicus but played a bigger role in

4189

02:35:46,230 --> 02:35:45,359

einstein einstein got from mark the idea

4190

02:35:47,030 --> 02:35:46,240

that

4191

02:35:52,469 --> 02:35:47,040

uh

4192

02:35:53,670 --> 02:35:52,479

it's really really meaning of two things

4193

02:35:55,030 --> 02:35:53,680

happening at the same time it's just a

4194

02:35:56,230 --> 02:35:55,040

wrong question we forget about that

4195

02:35:57,750 --> 02:35:56,240

that's not

4196

02:36:00,150 --> 02:35:57,760

meaningful i mean

4197

02:36:04,230 --> 02:36:02,550

also from mac heisenberg

4198

02:36:05,750 --> 02:36:04,240

took the idea that

4199

02:36:07,110 --> 02:36:05,760

the election doesn't have a position at

4200

02:36:10,150 --> 02:36:07,120

any time

4201

02:36:14,550 --> 02:36:10,160

directly from this is a this is a wrong

4202

02:36:19,670 --> 02:36:16,070

so there is a there's a tradition in

4203

02:36:22,870 --> 02:36:21,830

against the wrong kind of questions and

4204

02:36:24,630 --> 02:36:22,880

uh

4205

02:36:27,030 --> 02:36:24,640

i think what i'm saying here what i'm

4206

02:36:27,990 --> 02:36:27,040

trying to say here is that uh

4207

02:36:29,110 --> 02:36:28,000

um

4208

02:36:32,150 --> 02:36:29,120

it's uh

4209

02:36:34,630 --> 02:36:32,160

the notion of reality is good uh because

4210

02:36:36,550 --> 02:36:34,640

we we use it to distinguish the the

4211

02:36:37,429 --> 02:36:36,560

chair in the mirror from the chair

4212

02:36:39,349 --> 02:36:37,439

um

4213

02:36:41,110 --> 02:36:39,359

on which i can see it to distinguish the

4214

02:36:43,190 --> 02:36:41,120

dream from the

4215

02:36:45,030 --> 02:36:43,200

from what i see when i'm awake for

4216

02:36:46,870 --> 02:36:45,040

disclaiming what is uh what's in a play

4217

02:36:47,990 --> 02:36:46,880

or in a novel from what is not in a play

4218

02:36:48,790 --> 02:36:48,000

in a novel

4219

02:36:50,309 --> 02:36:48,800

if you

4220

02:36:53,110 --> 02:36:50,319

or or for distinguished i mean you tell

4221

02:36:55,349 --> 02:36:53,120

me that yesterday you met

4222

02:36:57,110 --> 02:36:55,359

john and say is that real or false

4223

02:36:59,030 --> 02:36:57,120

you lie that's this is meaningful this

4224

02:37:00,710 --> 02:36:59,040

is uh we know exactly what you mean by

4225

02:37:02,630 --> 02:37:00,720

real and false here

4226

02:37:06,070 --> 02:37:02,640

um

4227

02:37:10,550 --> 02:37:06,080

but then if we take this notion of real

4228

02:37:16,630 --> 02:37:12,230

extrapolated

4229

02:37:17,590 --> 02:37:16,640

to say everything we see is not real

4230

02:37:19,990 --> 02:37:17,600

uh

4231

02:37:21,110 --> 02:37:20,000

because everything we see

4232

02:37:24,950 --> 02:37:21,120

uh

4233

02:37:26,550 --> 02:37:24,960

has a level of illusion of some kind

4234

02:37:28,070 --> 02:37:26,560

much weaker kind of the mirror much

4235

02:37:29,510 --> 02:37:28,080

weaker kind

4236

02:37:31,510 --> 02:37:29,520

uh

4237

02:37:33,510 --> 02:37:31,520

it's good that we realize that there's a

4238

02:37:35,990 --> 02:37:33,520

level of illusion but then we are

4239

02:37:38,070 --> 02:37:36,000

postulating that there is a

4240

02:37:39,750 --> 02:37:38,080

underlying reality

4241

02:37:42,790 --> 02:37:39,760

behind that

4242

02:37:44,150 --> 02:37:42,800

and that postulation might be

4243

02:37:49,590 --> 02:37:44,160

wrong

4244

02:37:51,750 --> 02:37:49,600

it this way it's remarkable that science

4245

02:37:54,550 --> 02:37:51,760

failed to get to that ultimate reality

4246

02:37:56,630 --> 02:37:54,560

so far so why should we expect it wait

4247

02:37:59,590 --> 02:37:56,640

what is the multiple reality i mean

4248

02:38:01,750 --> 02:37:59,600

quantum fields i mean we don't even

4249

02:38:03,590 --> 02:38:01,760

know exactly what is a quantum field

4250

02:38:06,070 --> 02:38:03,600

because of the complication of quantum

4251
02:38:07,590 --> 02:38:06,080
mechanics we know it's a classical field

4252
02:38:10,550 --> 02:38:07,600
um

4253
02:38:12,870 --> 02:38:10,560
manifests itself with particles

4254
02:38:15,030 --> 02:38:12,880
okay but particles are not real

4255
02:38:17,590 --> 02:38:15,040
so we are confused on the ultimate

4256
02:38:18,710 --> 02:38:17,600
reality even in contemporary physics

4257
02:38:21,670 --> 02:38:18,720
um

4258
02:38:22,550 --> 02:38:21,680
in contemporary physics uh today

4259
02:38:24,230 --> 02:38:22,560
uh

4260
02:38:26,230 --> 02:38:24,240
not to mention about in philosophy in

4261
02:38:29,670 --> 02:38:26,240
general what is ultimate reality matter

4262
02:38:31,429 --> 02:38:29,680
energy god spirits language

4263
02:38:34,150 --> 02:38:31,439

everybody came out with a with an

4264

02:38:35,910 --> 02:38:34,160

ultimate reality story and and failed to

4265

02:38:37,349 --> 02:38:35,920

convince the others

4266

02:38:39,110 --> 02:38:37,359

um

4267

02:38:43,590 --> 02:38:39,120

so

4268

02:38:50,230 --> 02:38:47,110

interesting is to de-emphasize

4269

02:38:52,150 --> 02:38:50,240

the notion of ultimate reality

4270

02:38:55,190 --> 02:38:52,160

and interesting interesting interesting

4271

02:38:56,790 --> 02:38:55,200

and use the word reality at level by

4272

02:38:58,870 --> 02:38:56,800

level i mean there's

4273

02:39:01,349 --> 02:38:58,880

surreal that there's a chair there but

4274

02:39:03,110 --> 02:39:01,359

he's also real that that chair is as

4275

02:39:04,790 --> 02:39:03,120

some illusory thing it's also real

4276

02:39:07,349 --> 02:39:04,800

there's just a bunch of atoms both

4277

02:39:09,190 --> 02:39:07,359

things are true

4278

02:39:11,349 --> 02:39:09,200

and within each context something is

4279

02:39:13,110 --> 02:39:11,359

real something is it's also and we can

4280

02:39:15,110 --> 02:39:13,120

add context at

4281

02:39:17,349 --> 02:39:15,120

levels in which is a better

4282

02:39:19,830 --> 02:39:17,359

understanding of reality

4283

02:39:21,590 --> 02:39:19,840

uh without getting trapped into oh my

4284

02:39:22,950 --> 02:39:21,600

god we don't have access to reality we

4285

02:39:24,070 --> 02:39:22,960

do have access to reality that's the

4286

02:39:25,670 --> 02:39:24,080

chat

4287

02:39:27,110 --> 02:39:25,680

okay i'll explain my thoughts what

4288

02:39:28,950 --> 02:39:27,120

occurs to me and then we can get the

4289

02:39:30,469 --> 02:39:28,960

rapid fire questions and answers just

4290

02:39:32,550 --> 02:39:30,479

from the audience because you've been so

4291

02:39:34,710 --> 02:39:32,560

generous with your time thank you

4292

02:39:36,469 --> 02:39:34,720

is that cool

4293

02:39:38,870 --> 02:39:36,479

absolutely okay

4294

02:39:40,870 --> 02:39:38,880

this has been a very philosophical

4295

02:39:42,870 --> 02:39:40,880

uh take little physics little loop

4296

02:39:44,309 --> 02:39:42,880

quantum gravity lipocrypt this is very

4297

02:39:45,349 --> 02:39:44,319

very good

4298

02:39:47,670 --> 02:39:45,359

i guess

4299

02:39:49,510 --> 02:39:47,680

basic philosophy of science and physics

4300

02:39:51,190 --> 02:39:49,520

understanding and

4301

02:39:53,429 --> 02:39:51,200

the nature of reality

4302

02:39:54,790 --> 02:39:53,439

let me recapitulate what you said so i

4303

02:39:56,150 --> 02:39:54,800

make sure that we're on the same page

4304

02:39:57,510 --> 02:39:56,160

there are different ways that we use the

4305

02:39:58,790 --> 02:39:57,520

word reality just like there are

4306

02:39:59,910 --> 02:39:58,800

different ways we use the word time and

4307

02:40:02,550 --> 02:39:59,920

just like there are different ways we

4308

02:40:04,389 --> 02:40:02,560

use the word almost any noun essentially

4309

02:40:05,750 --> 02:40:04,399

depending on the context so let's

4310

02:40:07,590 --> 02:40:05,760

imagine we can put these contexts in

4311

02:40:09,830 --> 02:40:07,600

separate boxes much of the confusion

4312

02:40:10,950 --> 02:40:09,840

occurs when we think

4313

02:40:13,030 --> 02:40:10,960

well we

4314

02:40:15,510 --> 02:40:13,040

mean

4315

02:40:17,510 --> 02:40:15,520

well much of much of miscommunication is

4316

02:40:19,190 --> 02:40:17,520

we intend it to be from box a but you

4317

02:40:21,590 --> 02:40:19,200

perceive it as from being from box b so

4318

02:40:24,150 --> 02:40:21,600

the contexts are mixed up

4319

02:40:26,150 --> 02:40:24,160

and what i was wondering is when it

4320

02:40:27,910 --> 02:40:26,160

comes to reality even within the same

4321

02:40:30,469 --> 02:40:27,920

context

4322

02:40:32,070 --> 02:40:30,479

i don't see there being an internally

4323

02:40:33,990 --> 02:40:32,080

consistent even within the context and

4324

02:40:35,510 --> 02:40:34,000

by the way you mentioned wittgenstein

4325

02:40:37,750 --> 02:40:35,520

wittgenstein had this notion of language

4326

02:40:39,190 --> 02:40:37,760

games i believe the language games would

4327

02:40:40,950 --> 02:40:39,200

be the equivalent of

4328

02:40:42,870 --> 02:40:40,960

context here boxes

4329

02:40:45,030 --> 02:40:42,880

i'm wondering if there's an internally

4330

02:40:47,110 --> 02:40:45,040

in an internally consistent notion of

4331

02:40:48,389 --> 02:40:47,120

reality

4332

02:40:49,429 --> 02:40:48,399

okay so

4333

02:40:51,030 --> 02:40:49,439

well

4334

02:40:53,349 --> 02:40:51,040

and then where was i going with that ah

4335

02:40:55,590 --> 02:40:53,359

ah okay now my

4336

02:40:58,070 --> 02:40:55,600

what i think is at least i haven't seen

4337

02:40:59,830 --> 02:40:58,080

any and any time i try to come up with

4338

02:41:02,469 --> 02:40:59,840

well i haven't seen any internally

4339

02:41:03,750 --> 02:41:02,479

consistent definition of reality

4340

02:41:05,510 --> 02:41:03,760

now there are a couple answers to that

4341

02:41:07,910 --> 02:41:05,520

one is

4342

02:41:10,070 --> 02:41:07,920

the donald hoffman method

4343

02:41:11,910 --> 02:41:10,080

forget it so it's there's no reality

4344

02:41:13,750 --> 02:41:11,920

it's all unreal in some sense then

4345

02:41:15,750 --> 02:41:13,760

there's the phenomenological answer the

4346

02:41:18,389 --> 02:41:15,760

phenomenology answer which is actually

4347

02:41:20,630 --> 02:41:18,399

all you experience is real it's real to

4348

02:41:21,990 --> 02:41:20,640

you even if you're schizophrenic and you

4349

02:41:23,990 --> 02:41:22,000

see a snake in front of you that's real

4350

02:41:25,590 --> 02:41:24,000

to you

4351
02:41:27,510 --> 02:41:25,600
but then you actually took a different

4352
02:41:29,510 --> 02:41:27,520
route which i never occurred which is

4353
02:41:31,670 --> 02:41:29,520
please stop using the word reality just

4354
02:41:33,110 --> 02:41:31,680
let's forget about it so am i making a

4355
02:41:36,630 --> 02:41:33,120
correct summary and if i'm in yeah just

4356
02:41:41,030 --> 02:41:36,640
correct yes yes yes yes yes uh please

4357
02:41:42,630 --> 02:41:41,040
stop uh using the word reality uh

4358
02:41:43,670 --> 02:41:42,640
unlabeled and

4359
02:41:46,550 --> 02:41:43,680
uh

4360
02:41:49,429 --> 02:41:46,560
divorce the context reality i mean use

4361
02:41:51,110 --> 02:41:49,439
use the word reality in each context

4362
02:41:52,630 --> 02:41:51,120
so

4363
02:41:54,710 --> 02:41:52,640

it's like we should have reality sub a

4364

02:41:55,510 --> 02:41:54,720

reality sub b and make sure that we're

4365

02:41:59,429 --> 02:41:55,520

in

4366

02:42:02,230 --> 02:41:59,439

this is false

4367

02:42:04,790 --> 02:42:02,240

but that's a movie it's all false in in

4368

02:42:05,590 --> 02:42:04,800

a different sense of real so the the

4369

02:42:06,550 --> 02:42:05,600

the

4370

02:42:08,550 --> 02:42:06,560

realize

4371

02:42:10,389 --> 02:42:08,560

there's a variety of meaning with in the

4372

02:42:11,269 --> 02:42:10,399

context in which you

4373

02:42:13,830 --> 02:42:11,279

uh

4374

02:42:15,269 --> 02:42:13,840

in which you you use it so in a context

4375

02:42:17,510 --> 02:42:15,279

we

4376

02:42:19,910 --> 02:42:17,520

give you context and i

4377

02:42:21,590 --> 02:42:19,920

i give you a much better definition of

4378

02:42:24,230 --> 02:42:21,600

reality okay

4379

02:42:27,830 --> 02:42:24,240

in the context of the miserable written

4380

02:42:29,990 --> 02:42:27,840

by victor lugo i can absolutely

4381

02:42:31,670 --> 02:42:30,000

uniquely see what is real and what is

4382

02:42:33,429 --> 02:42:31,680

not real what is real is what is written

4383

02:42:35,910 --> 02:42:33,439

in the book it's not real it's what you

4384

02:42:37,590 --> 02:42:35,920

add it's not written the book okay in

4385

02:42:38,630 --> 02:42:37,600

the context of the history of the united

4386

02:42:41,190 --> 02:42:38,640

states

4387

02:42:42,230 --> 02:42:41,200

it's absolutely real

4388

02:42:43,830 --> 02:42:42,240

maybe

4389

02:42:45,269 --> 02:42:43,840

when we can make a mistake but we know

4390

02:42:47,110 --> 02:42:45,279

that to make a mistake so we know what

4391

02:42:48,710 --> 02:42:47,120

is real was not real that you know

4392

02:42:51,030 --> 02:42:48,720

george washington

4393

02:42:52,469 --> 02:42:51,040

announces becoming a king whatever uh

4394

02:42:53,670 --> 02:42:52,479

whatever happens

4395

02:42:54,710 --> 02:42:53,680

um

4396

02:42:56,950 --> 02:42:54,720

so

4397

02:43:01,190 --> 02:42:56,960

context by context we have a

4398

02:43:03,830 --> 02:43:01,200

with a clean notion of of reality which

4399

02:43:04,120 --> 02:43:03,840

allows us to make distinction

4400

02:43:06,870 --> 02:43:04,130

um

4401

02:43:08,950 --> 02:43:06,880

[Music]

4402

02:43:10,870 --> 02:43:08,960

between real things and not real things

4403

02:43:13,750 --> 02:43:10,880

it's a unique

4404

02:43:16,790 --> 02:43:13,760

word real reality to reality real not

4405

02:43:22,150 --> 02:43:16,800

real outside all context

4406

02:43:26,630 --> 02:43:24,950

all right yeah so fast yep yep the

4407

02:43:29,349 --> 02:43:26,640

information paradox you said it's like

4408

02:43:31,030 --> 02:43:29,359

falling in love with holography and that

4409

02:43:32,309 --> 02:43:31,040

the entropy inside a black hole can be

4410

02:43:34,830 --> 02:43:32,319

different than the outside so can you

4411

02:43:37,750 --> 02:43:34,840

explain what you mean by

4412

02:43:39,510 --> 02:43:37,760

that yes um

4413

02:43:41,510 --> 02:43:39,520

right now in the uh

4414

02:43:43,429 --> 02:43:41,520

community of physicists

4415

02:43:45,349 --> 02:43:43,439

uh there have been a a

4416

02:43:47,349 --> 02:43:45,359

separation between two communities which

4417

02:43:49,110 --> 02:43:47,359

have completely different opinions

4418

02:43:51,030 --> 02:43:49,120

about the

4419

02:43:53,750 --> 02:43:51,040

black hole paradox

4420

02:43:55,429 --> 02:43:53,760

one community it's convinced that

4421

02:43:58,070 --> 02:43:55,439

there's a problem

4422

02:44:00,469 --> 02:43:58,080

the problem it's

4423

02:44:02,469 --> 02:44:00,479

before quantum gravity so before the end

4424

02:44:05,830 --> 02:44:02,479

of the evaporation

4425

02:44:08,309 --> 02:44:05,840

and the problem is due to the fact that

4426
02:44:09,750 --> 02:44:08,319
the black hole shrinks and people are

4427
02:44:11,670 --> 02:44:09,760
convinced

4428
02:44:12,870 --> 02:44:11,680
that the number of states of the black

4429
02:44:16,790 --> 02:44:12,880
hole

4430
02:44:19,349 --> 02:44:16,800
um it's bound by the area

4431
02:44:21,349 --> 02:44:19,359
by the pakistan um

4432
02:44:24,230 --> 02:44:21,359
hawking entropy

4433
02:44:27,110 --> 02:44:24,240
and therefore uh the problem is that the

4434
02:44:28,309 --> 02:44:27,120
state outside seems to be um

4435
02:44:30,230 --> 02:44:28,319
thermal

4436
02:44:33,190 --> 02:44:30,240
and uh

4437
02:44:34,950 --> 02:44:33,200
in pure state and

4438
02:44:36,309 --> 02:44:34,960

for that to be possible to save

4439

02:44:38,870 --> 02:44:36,319

unitarity

4440

02:44:40,389 --> 02:44:38,880

uh information should be somewhere

4441

02:44:42,550 --> 02:44:40,399

and the only place we could be

4442

02:44:44,150 --> 02:44:42,560

reasonably inside the black hole but

4443

02:44:45,349 --> 02:44:44,160

there are not enough states inside the

4444

02:44:46,550 --> 02:44:45,359

black hole

4445

02:44:48,469 --> 02:44:46,560

because of

4446

02:44:49,910 --> 02:44:48,479

horizon has shrunk

4447

02:44:53,510 --> 02:44:49,920

and this has

4448

02:44:55,190 --> 02:44:53,520

created a huge a huge problem

4449

02:44:56,870 --> 02:44:55,200

and

4450

02:44:58,630 --> 02:44:56,880

there are

4451
02:45:01,110 --> 02:44:58,640
complicated solutions which have been

4452
02:45:03,190 --> 02:45:01,120
studied today and people are sort of

4453
02:45:06,070 --> 02:45:03,200
getting convinced that this complicated

4454
02:45:07,990 --> 02:45:06,080
solution of the the way out

4455
02:45:10,070 --> 02:45:08,000
the other half of the community

4456
02:45:12,830 --> 02:45:10,080
which are most relativist and not

4457
02:45:14,309 --> 02:45:12,840
particle physics and people like me

4458
02:45:15,910 --> 02:45:14,319
um uh

4459
02:45:17,990 --> 02:45:15,920
don't just don't believe this story

4460
02:45:19,910 --> 02:45:18,000
absolutely because to create this

4461
02:45:21,750 --> 02:45:19,920
paradox you have to believe quantum

4462
02:45:24,230 --> 02:45:21,760
mechanics which is unitarian we all

4463
02:45:25,590 --> 02:45:24,240

expect quantum mechanics to be unity you

4464

02:45:27,190 --> 02:45:25,600

have to believe uh

4465

02:45:32,150 --> 02:45:27,200

uh

4466

02:45:34,870 --> 02:45:32,160

generativity holds and some

4467

02:45:36,150 --> 02:45:34,880

reasons we don't expect one to gravity

4468

02:45:39,110 --> 02:45:36,160

and

4469

02:45:41,269 --> 02:45:39,120

believe

4470

02:45:42,870 --> 02:45:41,279

an additional assumption

4471

02:45:45,349 --> 02:45:42,880

which is the number of black holes

4472

02:45:47,510 --> 02:45:45,359

states inside the black hole it's bound

4473

02:45:49,349 --> 02:45:47,520

by the area

4474

02:45:51,349 --> 02:45:49,359

and that

4475

02:45:53,590 --> 02:45:51,359

has no strong ground

4476

02:45:55,750 --> 02:45:53,600

people got in love with the idea

4477

02:45:57,190 --> 02:45:55,760

because there are calculations that

4478

02:45:59,190 --> 02:45:57,200

allow you to describe black hole in

4479

02:46:02,790 --> 02:45:59,200

terms of a final number of states bound

4480

02:46:03,590 --> 02:46:02,800

by the area but this is a description

4481

02:46:06,230 --> 02:46:03,600

uh

4482

02:46:08,389 --> 02:46:06,240

of what you see from the outside

4483

02:46:11,670 --> 02:46:08,399

as long as the horizon is an event

4484

02:46:13,670 --> 02:46:11,680

horizon it's horizon forever

4485

02:46:15,429 --> 02:46:13,680

and the horizon black hole is not an

4486

02:46:17,830 --> 02:46:15,439

eventualizer because at some point the

4487

02:46:18,950 --> 02:46:17,840

black hole becomes very small something

4488

02:46:21,030 --> 02:46:18,960

happens

4489

02:46:22,550 --> 02:46:21,040

and at that point it may very well be

4490

02:46:24,630 --> 02:46:22,560

that the big information which is

4491

02:46:25,830 --> 02:46:24,640

outside comes out

4492

02:46:28,230 --> 02:46:25,840

okay

4493

02:46:29,110 --> 02:46:28,240

and the confusion the subtle confusion

4494

02:46:30,550 --> 02:46:29,120

here

4495

02:46:33,510 --> 02:46:30,560

it's that

4496

02:46:36,710 --> 02:46:35,110

is used to say

4497

02:46:38,790 --> 02:46:36,720

that the phenomenon entropy is bounded

4498

02:46:40,790 --> 02:46:38,800

by the thermodynamical entropy namely

4499

02:46:42,309 --> 02:46:40,800

phenomena entropy is in

4500

02:46:43,830 --> 02:46:42,319

the the the

4501

02:46:45,990 --> 02:46:43,840

the amount of information due to the

4502

02:46:47,269 --> 02:46:46,000

entanglement between the inside the two

4503

02:46:49,349 --> 02:46:47,279

things

4504

02:46:50,790 --> 02:46:49,359

at the terminal entropy

4505

02:46:52,630 --> 02:46:50,800

count the number of state if you

4506

02:46:54,630 --> 02:46:52,640

interact terminally with something and

4507

02:46:56,309 --> 02:46:54,640

people say well of course for neumann

4508

02:46:57,590 --> 02:46:56,319

entropy it's bounded by the

4509

02:46:59,030 --> 02:46:57,600

thermodynamical entropy because the

4510

02:47:00,070 --> 02:46:59,040

thermodynamic entropy count the number

4511

02:47:02,070 --> 02:47:00,080

you'll see it if you don't have this

4512

02:47:03,349 --> 02:47:02,080

state you cannot have fun

4513

02:47:04,830 --> 02:47:03,359

phenomena

4514

02:47:06,950 --> 02:47:04,840

but that's wrong

4515

02:47:10,469 --> 02:47:06,960

because uh

4516

02:47:13,030 --> 02:47:10,479

if one part of of the interior system

4517

02:47:15,190 --> 02:47:13,040

is thermally disconnected you can still

4518

02:47:18,070 --> 02:47:15,200

have a big volume and entropy

4519

02:47:19,670 --> 02:47:18,080

and a decreasing thermodynamical entropy

4520

02:47:22,070 --> 02:47:19,680

and that's exactly what happened in

4521

02:47:23,510 --> 02:47:22,080

black holes

4522

02:47:27,269 --> 02:47:23,520

and

4523

02:47:29,349 --> 02:47:27,279

people who are sort of blinded by

4524

02:47:33,590 --> 02:47:29,359

over excessive

4525

02:47:36,870 --> 02:47:33,600

taking a strong version of holography

4526

02:47:38,070 --> 02:47:36,880

just don't see that very basic

4527

02:47:40,309 --> 02:47:38,080

point

4528

02:47:41,590 --> 02:47:40,319

and don't see that if you give a full

4529

02:47:43,429 --> 02:47:41,600

description

4530

02:47:45,910 --> 02:47:43,439

that include what happened after the end

4531

02:47:47,830 --> 02:47:45,920

of evaporation you can have a phenomenon

4532

02:47:50,150 --> 02:47:47,840

to be much larger than the thermodynamic

4533

02:47:51,910 --> 02:47:50,160

enterprise simply talking the whole of

4534

02:47:53,349 --> 02:47:51,920

the black hole shrinks becomes smaller

4535

02:47:55,429 --> 02:47:53,359

and smaller and smaller

4536

02:47:58,309 --> 02:47:55,439

where the backhoe evaporates

4537

02:48:00,150 --> 02:47:58,319

but the inside remains very big there's

4538

02:48:01,590 --> 02:48:00,160

a lot of information there

4539

02:48:02,790 --> 02:48:01,600

which is not lost

4540

02:48:04,389 --> 02:48:02,800

where the black hole ends the

4541

02:48:06,469 --> 02:48:04,399

evaporation when you say the inside

4542

02:48:07,510 --> 02:48:06,479

remember slowly comes out the inside of

4543

02:48:08,870 --> 02:48:07,520

yeah

4544

02:48:14,309 --> 02:48:08,880

the black hole

4545

02:48:16,389 --> 02:48:14,319

yep the horizon and then there is an

4546

02:48:18,150 --> 02:48:16,399

inside which is very very big that's the

4547

02:48:20,630 --> 02:48:18,160

point i mean you can have a

4548

02:48:23,429 --> 02:48:20,640

very very big spatial

4549

02:48:26,309 --> 02:48:23,439

space like surfaces are huge

4550

02:48:28,070 --> 02:48:26,319

okay and that's where the information is

4551
02:48:29,670 --> 02:48:28,080
and at the end of evaporation now we're

4552
02:48:31,269 --> 02:48:29,680
in quantum gravity and with loop quantum

4553
02:48:32,309 --> 02:48:31,279
gravity you can do calculations to what

4554
02:48:34,309 --> 02:48:32,319
happened

4555
02:48:35,830 --> 02:48:34,319
and you there's there's a quantum

4556
02:48:38,070 --> 02:48:35,840
transition to a region in which the

4557
02:48:39,990 --> 02:48:38,080
inside is still there and slowly it

4558
02:48:41,830 --> 02:48:40,000
leaks out all the information

4559
02:48:43,750 --> 02:48:41,840
so i think that there's a

4560
02:48:47,349 --> 02:48:43,760
perfectly

4561
02:48:52,630 --> 02:48:50,070
which shows that it's not true

4562
02:48:54,630 --> 02:48:52,640
that is a black hole information problem

4563
02:48:55,990 --> 02:48:54,640

the belief in the black hole information

4564

02:48:58,870 --> 02:48:56,000

problem

4565

02:49:01,269 --> 02:48:58,880

is based on a

4566

02:49:06,469 --> 02:49:01,279

a dogma

4567

02:49:08,469 --> 02:49:06,479

supported by anything

4568

02:49:10,070 --> 02:49:08,479

that the

4569

02:49:12,710 --> 02:49:10,080

uh the number of states of black hole

4570

02:49:14,870 --> 02:49:12,720

computer from the outside also include

4571

02:49:16,950 --> 02:49:14,880

the information inside

4572

02:49:18,550 --> 02:49:16,960

in popular science you always hear that

4573

02:49:19,830 --> 02:49:18,560

when someone falls into the black hole

4574

02:49:21,269 --> 02:49:19,840

you won't see them

4575

02:49:22,630 --> 02:49:21,279

well you'll see them freeze right at the

4576
02:49:24,150 --> 02:49:22,640
horizon

4577
02:49:27,990 --> 02:49:24,160
and there you'll see their watch frozen

4578
02:49:29,670 --> 02:49:28,000
too now if the black hole event yeah

4579
02:49:30,790 --> 02:49:29,680
yeah

4580
02:49:31,910 --> 02:49:30,800
this is

4581
02:49:33,750 --> 02:49:31,920
we don't know that because that's the

4582
02:49:36,550 --> 02:49:33,760
benefit of gravity see that's that's

4583
02:49:37,670 --> 02:49:36,560
exactly the that's exactly the problem

4584
02:49:39,510 --> 02:49:37,680
uh

4585
02:49:42,230 --> 02:49:39,520
when time goes on

4586
02:49:43,990 --> 02:49:42,240
okay you see what you see somebody is

4587
02:49:45,590 --> 02:49:44,000
crossing the black hole

4588
02:49:47,190 --> 02:49:45,600

so the person crossing black hole of

4589

02:49:49,750 --> 02:49:47,200

course crosses it like oh i mean nothing

4590

02:49:51,110 --> 02:49:49,760

particular happened crossing the horizon

4591

02:49:53,190 --> 02:49:51,120

just normal

4592

02:49:56,150 --> 02:49:53,200

normal time going back

4593

02:49:57,750 --> 02:49:56,160

but the light rays that it emits

4594

02:50:01,110 --> 02:49:57,760

uh gets to you

4595

02:50:03,590 --> 02:50:01,120

later and later and later and later okay

4596

02:50:06,469 --> 02:50:03,600

now if the horizon is an eventerizer so

4597

02:50:09,030 --> 02:50:06,479

if the horizon stays there forever yeah

4598

02:50:11,750 --> 02:50:09,040

you can go to infinity and you only see

4599

02:50:14,230 --> 02:50:11,760

the person before crossing

4600

02:50:15,830 --> 02:50:14,240

but we don't know in fact the the rise

4601
02:50:17,830 --> 02:50:15,840
is not an element right the rise does

4602
02:50:19,429 --> 02:50:17,840
not go to infinity because at some point

4603
02:50:21,349 --> 02:50:19,439
the black hole becomes plunkin and

4604
02:50:22,950 --> 02:50:21,359
that's where in quantum gravity and when

4605
02:50:24,870 --> 02:50:22,960
in quantum gravity there is a quantum

4606
02:50:26,309 --> 02:50:24,880
transition

4607
02:50:28,389 --> 02:50:26,319
after which

4608
02:50:31,190 --> 02:50:28,399
the information outside can go outside

4609
02:50:33,190 --> 02:50:31,200
okay so if you wait long enough

4610
02:50:34,870 --> 02:50:33,200
you see inside the black hole

4611
02:50:37,269 --> 02:50:34,880
interesting that's the point

4612
02:50:38,790 --> 02:50:37,279
interesting okay next one do you find

4613
02:50:40,870 --> 02:50:38,800

that your ability to learn let's say

4614

02:50:42,790 --> 02:50:40,880

math and physics has increased with age

4615

02:50:47,030 --> 02:50:42,800

or decreased

4616

02:50:50,389 --> 02:50:47,040

decreased decreased much decreased i uh

4617

02:50:52,389 --> 02:50:50,399

when i was in my 20s i could take a

4618

02:50:55,349 --> 02:50:52,399

complicated mathematically complicated

4619

02:50:56,710 --> 02:50:55,359

paper just sit down on a chair and

4620

02:50:58,870 --> 02:50:56,720

read it through and i would get

4621

02:51:00,469 --> 02:50:58,880

everything easily

4622

02:51:03,269 --> 02:51:00,479

and then it slowly became more

4623

02:51:06,070 --> 02:51:03,279

complicated and now in my 60s i struggle

4624

02:51:08,870 --> 02:51:06,080

i go slow i read less papers so my

4625

02:51:11,190 --> 02:51:08,880

capacity to learn is decreasing

4626
02:51:13,590 --> 02:51:11,200
and also

4627
02:51:16,550 --> 02:51:13,600
i think my flexibility

4628
02:51:18,950 --> 02:51:16,560
of thinking is going down i tend to know

4629
02:51:20,630 --> 02:51:18,960
much more things before i have much more

4630
02:51:22,630 --> 02:51:20,640
developed views

4631
02:51:24,630 --> 02:51:22,640
before i know more things

4632
02:51:25,990 --> 02:51:24,640
i see when other people are wrong

4633
02:51:27,349 --> 02:51:26,000
because i know things they don't know

4634
02:51:29,269 --> 02:51:27,359
it's happened much more often than

4635
02:51:31,349 --> 02:51:29,279
before i mean it's easy to see the

4636
02:51:32,950 --> 02:51:31,359
mistakes of the others because because i

4637
02:51:34,710 --> 02:51:32,960
know more things everybody getting

4638
02:51:36,150 --> 02:51:34,720

colder no small things

4639

02:51:37,349 --> 02:51:36,160

so that's why all the people why is it

4640

02:51:39,750 --> 02:51:37,359

but also

4641

02:51:40,870 --> 02:51:39,760

i'm more stupid because i'm more trapped

4642

02:51:42,630 --> 02:51:40,880

in my own thinking i have more

4643

02:51:45,670 --> 02:51:42,640

difficulty of coming out from my own

4644

02:51:48,710 --> 02:51:47,030

what would you have done differently in

4645

02:51:49,990 --> 02:51:48,720

the development of your theory it could

4646

02:51:51,590 --> 02:51:50,000

be as simple as i would have spent more

4647

02:51:53,429 --> 02:51:51,600

time going for walks with lee than

4648

02:51:55,750 --> 02:51:53,439

sitting down or i would have spent more

4649

02:51:58,070 --> 02:51:55,760

time thinking about

4650

02:51:59,910 --> 02:51:58,080

about holography like ads cfd

4651
02:52:01,670 --> 02:51:59,920
correspondence for whatever reason or

4652
02:52:03,349 --> 02:52:01,680
you would have spent less time arguing

4653
02:52:05,030 --> 02:52:03,359
with your like what is it that you would

4654
02:52:10,150 --> 02:52:05,040
have done differently in the development

4655
02:52:17,910 --> 02:52:11,510
um

4656
02:52:23,910 --> 02:52:20,630
people have raised objections

4657
02:52:28,230 --> 02:52:25,750
i got convinced that these objections

4658
02:52:31,269 --> 02:52:28,240
were wrong

4659
02:52:33,269 --> 02:52:31,279
and i just ignored

4660
02:52:36,950 --> 02:52:33,279
that and just

4661
02:52:36,960 --> 02:52:39,269
and

4662
02:52:57,110 --> 02:52:40,150
i

4663
02:52:58,070 --> 02:52:57,120

um

4664

02:53:17,510 --> 02:52:58,080

i

4665

02:53:19,349 --> 02:53:17,520

um

4666

02:53:21,670 --> 02:53:19,359

and and go my own way and something

4667

02:53:23,590 --> 02:53:21,680

sometimes works very well

4668

02:53:26,309 --> 02:53:23,600

but sometimes has

4669

02:53:27,750 --> 02:53:26,319

you know created long misunderstanding

4670

02:53:30,150 --> 02:53:27,760

so i should have

4671

02:53:32,710 --> 02:53:30,160

more engaged with with criticism trying

4672

02:53:33,670 --> 02:53:32,720

to respond and be more

4673

02:53:37,910 --> 02:53:33,680

more

4674

02:53:39,830 --> 02:53:37,920

part of the group and just debating with

4675

02:53:41,429 --> 02:53:39,840

the group

4676

02:53:43,269 --> 02:53:41,439

okay this question comes from stefan

4677

02:53:45,830 --> 02:53:43,279

alexander he's a professor of

4678

02:53:47,990 --> 02:53:45,840

theoretical physics and i know he's a

4679

02:53:49,910 --> 02:53:48,000

great guy great great he's the writer of

4680

02:53:51,510 --> 02:53:49,920

fear of black universe fear of a black

4681

02:53:53,190 --> 02:53:51,520

universe and the link to that is in the

4682

02:53:55,349 --> 02:53:53,200

description also i'll be speaking with

4683

02:53:57,670 --> 02:53:55,359

stefan so that's either out or

4684

02:53:59,349 --> 02:53:57,680

coming up how does time play into

4685

02:54:00,630 --> 02:53:59,359

quantum gravity

4686

02:54:02,070 --> 02:54:00,640

you've mentioned it plays into quantum

4687

02:54:05,349 --> 02:54:02,080

mechanics does it play into quantum

4688

02:54:09,349 --> 02:54:07,670

um

4689

02:54:11,349 --> 02:54:09,359

it does not

4690

02:54:13,269 --> 02:54:11,359

i think that's uh

4691

02:54:15,670 --> 02:54:13,279

that's the bottom line also my book once

4692

02:54:18,469 --> 02:54:15,680

you go to quantum gravity

4693

02:54:20,469 --> 02:54:18,479

uh you better forget entirely

4694

02:54:21,990 --> 02:54:20,479

the the word time

4695

02:54:24,230 --> 02:54:22,000

just forget about it

4696

02:54:26,070 --> 02:54:24,240

you have a bunch of variables

4697

02:54:27,750 --> 02:54:26,080

which describe the gravitational fields

4698

02:54:29,590 --> 02:54:27,760

and the terminic fields whatever fields

4699

02:54:31,030 --> 02:54:29,600

are around whatever is

4700

02:54:33,269 --> 02:54:31,040

it's it's your

4701
02:54:34,870 --> 02:54:33,279
ingredients as far as we know today

4702
02:54:37,349 --> 02:54:34,880
these are the ingredients of the world

4703
02:54:39,269 --> 02:54:37,359
electrons quarks uh electromagnetic

4704
02:54:41,750 --> 02:54:39,279
field gravitation

4705
02:54:43,590 --> 02:54:41,760
and uh you have

4706
02:54:45,990 --> 02:54:43,600
relations

4707
02:54:48,950 --> 02:54:46,000
uh between these

4708
02:54:51,510 --> 02:54:48,960
which you think in terms of uh

4709
02:54:53,670 --> 02:54:51,520
uh there is a quantum region

4710
02:54:55,349 --> 02:54:53,680
if you want a space-time region

4711
02:54:57,910 --> 02:54:55,359
and outside

4712
02:55:00,150 --> 02:54:57,920
if if i if i see something

4713
02:55:01,269 --> 02:55:00,160

around what is the probability of seeing

4714

02:55:03,590 --> 02:55:01,279

that

4715

02:55:05,670 --> 02:55:03,600

and you don't have to say

4716

02:55:07,429 --> 02:55:05,680

how much time has passed which one is a

4717

02:55:09,910 --> 02:55:07,439

time variable

4718

02:55:11,510 --> 02:55:09,920

that comes out naturally

4719

02:55:14,150 --> 02:55:11,520

because

4720

02:55:16,309 --> 02:55:14,160

if the classical limit of the amplitudes

4721

02:55:18,950 --> 02:55:16,319

turn out to be correct they just give

4722

02:55:21,110 --> 02:55:18,960

generativity so in the classical limit

4723

02:55:23,590 --> 02:55:21,120

you have space times evolving and then

4724

02:55:26,309 --> 02:55:23,600

you can you know uh time is just

4725

02:55:29,030 --> 02:55:26,319

whatever passes around the time like

4726
02:55:31,190 --> 02:55:29,040
gold line but in the fundamental quantum

4727
02:55:34,070 --> 02:55:31,200
gravity theory just forget about time

4728
02:55:36,550 --> 02:55:34,080
entirely don't talk about that

4729
02:55:37,830 --> 02:55:36,560
time has in the various meaning in which

4730
02:55:40,790 --> 02:55:37,840
we

4731
02:55:42,870 --> 02:55:40,800
uh

4732
02:55:43,750 --> 02:55:42,880
it's just something that happens at

4733
02:55:46,230 --> 02:55:43,760
later

4734
02:55:48,230 --> 02:55:46,240
approximations the space time comes at

4735
02:55:50,790 --> 02:55:48,240
the large scale approximation and

4736
02:55:53,030 --> 02:55:50,800
oriented time comes from thermodynamics

4737
02:55:55,670 --> 02:55:53,040
in quantum gravity the only temporal

4738
02:55:57,670 --> 02:55:55,680

notion it's very weak is that you

4739

02:55:58,870 --> 02:55:57,680

describe process so what you describe is

4740

02:55:59,670 --> 02:55:58,880

a process

4741

02:56:46,870 --> 02:55:59,680

a

4742

02:56:48,389 --> 02:56:46,880

does the notion

4743

02:56:52,309 --> 02:56:48,399

that everything is relational not lead

4744

02:56:56,150 --> 02:56:54,070

it's turtle salted way down in my

4745

02:56:57,990 --> 02:56:56,160

opinion

4746

02:57:00,070 --> 02:56:58,000

and i think what uh what

4747

02:57:02,870 --> 02:57:00,080

uh i mean

4748

02:57:05,190 --> 02:57:02,880

i i think the basic uh

4749

02:57:06,950 --> 02:57:05,200

i mean i know of course uh

4750

02:57:10,150 --> 02:57:06,960

bananas uh

4751
02:57:12,790 --> 02:57:10,160
uh cultural uh um ideas

4752
02:57:14,150 --> 02:57:12,800
he defended a rather strong version of

4753
02:57:17,830 --> 02:57:14,160
idealism

4754
02:57:19,670 --> 02:57:17,840
in which um everything is mental

4755
02:57:22,469 --> 02:57:19,680
and uh um

4756
02:57:24,469 --> 02:57:22,479
i think that the mental phenomena

4757
02:57:26,469 --> 02:57:24,479
are not

4758
02:57:35,269 --> 02:57:26,479
more

4759
02:57:38,309 --> 02:57:35,279
the

4760
02:57:40,309 --> 02:57:38,319
phenomena

4761
02:57:41,510 --> 02:57:40,319
in fact i think if

4762
02:57:43,910 --> 02:57:41,520
if there is a

4763
02:57:45,830 --> 02:57:43,920

dependence relation the dependence

4764

02:57:46,630 --> 02:57:45,840

relation is other way around

4765

02:57:47,510 --> 02:57:46,640

so

4766

02:57:48,550 --> 02:57:47,520

um

4767

02:57:50,230 --> 02:57:48,560

if you want to understand mental

4768

02:57:52,309 --> 02:57:50,240

phenomena

4769

02:57:54,389 --> 02:57:52,319

we understand them better

4770

02:57:56,550 --> 02:57:54,399

starting from physical facts and from

4771

02:57:57,830 --> 02:57:56,560

that deriving mental phenomena

4772

02:57:59,510 --> 02:57:57,840

um

4773

02:58:01,830 --> 02:57:59,520

the other way around doesn't work in my

4774

02:58:03,510 --> 02:58:01,840

opinion the other way around leaves us

4775

02:58:05,190 --> 02:58:03,520

the impossibility of doing science we

4776
02:58:06,630 --> 02:58:05,200
don't derive physical phenomena from

4777
02:58:07,990 --> 02:58:06,640
mental phenomena but the other way

4778
02:58:09,750 --> 02:58:08,000
around we do

4779
02:58:11,030 --> 02:58:09,760
so of the two

4780
02:58:13,510 --> 02:58:11,040
uh

4781
02:58:16,830 --> 02:58:13,520
physically in a large sense

4782
02:58:20,469 --> 02:58:16,840
uh i don't mean material i'm in

4783
02:58:21,349 --> 02:58:20,479
physics systems interacting hypothesis

4784
02:58:22,150 --> 02:58:21,359
uh

4785
02:58:23,910 --> 02:58:22,160
are

4786
02:58:24,950 --> 02:58:23,920
more fundamental in sense of the ground

4787
02:58:26,790 --> 02:58:24,960
better

4788
02:58:30,070 --> 02:58:26,800

mental phenomena i think the

4789

02:58:33,750 --> 02:58:30,080

the mistake of idealism is to

4790

02:58:36,630 --> 02:58:33,760

don't see uh

4791

02:58:37,010 --> 02:58:36,640

one of the main insight

4792

02:58:38,309 --> 02:58:37,020

um

4793

02:58:41,349 --> 02:58:38,319

[Music]

4794

02:58:47,750 --> 02:58:42,469

in

4795

02:58:49,429 --> 02:58:47,760

the mental is as illusory

4796

02:58:53,190 --> 02:58:49,439

in in buddhist language as the external

4797

02:58:55,110 --> 02:58:53,200

world so the self is us

4798

02:58:56,790 --> 02:58:55,120

left um

4799

02:58:57,910 --> 02:58:56,800

less

4800

02:59:01,030 --> 02:58:57,920

founded

4801

02:59:02,790 --> 02:59:01,040

as this glass or this pen

4802

02:59:04,790 --> 02:59:02,800

um when i think about myself the

4803

02:59:07,030 --> 02:59:04,800

illusion of this is the cartesian

4804

02:59:08,790 --> 02:59:07,040

illusion this is evident

4805

02:59:09,990 --> 02:59:08,800

this is immediate this cannot be

4806

02:59:11,190 --> 02:59:10,000

discounted

4807

02:59:12,389 --> 02:59:11,200

it's wrong

4808

02:59:14,550 --> 02:59:12,399

um

4809

02:59:17,670 --> 02:59:14,560

if there's anything what is evident for

4810

02:59:20,309 --> 02:59:17,680

me is this pen is not me then me it's a

4811

02:59:22,950 --> 02:59:20,319

complicated cultural construct social

4812

02:59:24,550 --> 02:59:22,960

construct cultural construct what i

4813

02:59:26,870 --> 02:59:24,560

directly know about the world is that

4814

02:59:29,349 --> 02:59:26,880

there is this pen

4815

02:59:31,510 --> 02:59:29,359

uh i if you say well there is also you

4816

02:59:33,750 --> 02:59:31,520

in the world i say oh yeah it's also me

4817

02:59:35,190 --> 02:59:33,760

and what is me i have to i have to do so

4818

02:59:37,030 --> 02:59:35,200

a reflection

4819

02:59:38,150 --> 02:59:37,040

a story of thinking and if you read the

4820

02:59:40,150 --> 02:59:38,160

card

4821

02:59:43,670 --> 02:59:40,160

there's a logo of this idea

4822

02:59:45,030 --> 02:59:43,680

the card never said that um

4823

02:59:46,309 --> 02:59:45,040

the self

4824

02:59:48,230 --> 02:59:46,319

it's immediate

4825

02:59:49,910 --> 02:59:48,240

he said if you start doubting then you

4826
02:59:51,590 --> 02:59:49,920
go through a complicated cultural

4827
02:59:53,429 --> 02:59:51,600
process of doubting

4828
02:59:54,790 --> 02:59:53,439
which is due to his culture his

4829
02:59:57,110 --> 02:59:54,800
philosophies

4830
02:59:58,710 --> 02:59:57,120
and this leads him

4831
03:00:00,790 --> 02:59:58,720
to thinking about the self and they

4832
03:00:02,070 --> 03:00:00,800
think if i'm doubting them and thinking

4833
03:00:03,990 --> 03:00:02,080
if i'm thinking there should be

4834
03:00:06,389 --> 03:00:04,000
something thinking is this thinking the

4835
03:00:08,389 --> 03:00:06,399
self but the something thinking is not

4836
03:00:10,790 --> 03:00:08,399
the self it's a symbol of the processes

4837
03:00:12,230 --> 03:00:10,800
that matter does in my brain

4838
03:00:14,550 --> 03:00:12,240

so that's why i disagree with the idea

4839

03:00:16,790 --> 03:00:14,560

it is

4840

03:00:18,550 --> 03:00:16,800

why is it that the mental states and the

4841

03:00:20,710 --> 03:00:18,560

self are are they equivalent in your

4842

03:00:21,990 --> 03:00:20,720

mind in your mind are they no they're

4843

03:00:23,510 --> 03:00:22,000

two different things no they're two

4844

03:00:25,429 --> 03:00:23,520

different things of course they're two

4845

03:00:27,990 --> 03:00:25,439

different things the self is a it's a

4846

03:00:29,670 --> 03:00:28,000

it's uh um

4847

03:00:32,070 --> 03:00:29,680

let me not define the self uh there's

4848

03:00:34,070 --> 03:00:32,080

only something sure states as uh other

4849

03:00:35,110 --> 03:00:34,080

than men but i think that

4850

03:00:37,510 --> 03:00:35,120

um

4851

03:00:38,710 --> 03:00:37,520

what i said applied to both

4852

03:00:40,870 --> 03:00:38,720

and of course

4853

03:00:42,870 --> 03:00:40,880

the card was talking about the self

4854

03:00:43,910 --> 03:00:42,880

uh some people talk about mental state

4855

03:00:46,950 --> 03:00:43,920

in the in

4856

03:00:48,870 --> 03:00:46,960

um i think both are

4857

03:00:50,830 --> 03:00:48,880

like chairs

4858

03:00:56,070 --> 03:00:50,840

complicated construction we use to

4859

03:01:00,710 --> 03:00:58,469

uh you mentioned that science would be

4860

03:01:04,070 --> 03:01:00,720

difficult or if not impossible to do if

4861

03:01:06,469 --> 03:01:04,080

idealism was correct why can't we just

4862

03:01:08,230 --> 03:01:06,479

say see for me the way that i see

4863

03:01:10,389 --> 03:01:08,240

science is that science doesn't

4864

03:01:11,910 --> 03:01:10,399

presume a metaphysics it doesn't

4865

03:01:13,990 --> 03:01:11,920

actually say whether

4866

03:01:16,309 --> 03:01:14,000

there's an immaterial or material or

4867

03:01:17,910 --> 03:01:16,319

mental reality it's like a method now

4868

03:01:19,269 --> 03:01:17,920

people can disagree with the definition

4869

03:01:22,469 --> 03:01:19,279

of science

4870

03:01:25,030 --> 03:01:22,479

regardless why can't

4871

03:01:26,950 --> 03:01:25,040

idealism be correct and simply say

4872

03:01:28,790 --> 03:01:26,960

there are regularities to these mental

4873

03:01:31,670 --> 03:01:28,800

states and we see these regularities

4874

03:01:33,190 --> 03:01:31,680

these patterns of perception and we call

4875

03:01:35,110 --> 03:01:33,200

that physics

4876
03:01:41,590 --> 03:01:35,120
and we perform science that just as we

4877
03:01:47,269 --> 03:01:43,110
sure sure no i

4878
03:01:50,070 --> 03:01:49,030
science is neutral

4879
03:01:52,550 --> 03:01:50,080
uh

4880
03:01:54,790 --> 03:01:52,560
but if i want to use

4881
03:01:56,309 --> 03:01:54,800
science uh

4882
03:01:58,630 --> 03:01:56,319
what i was saying is something much more

4883
03:02:02,389 --> 03:01:58,640
uh much less philosophical if you want

4884
03:02:05,269 --> 03:02:02,399
um if i want you to if i want

4885
03:02:07,349 --> 03:02:05,279
to use science to make a story about how

4886
03:02:10,230 --> 03:02:07,359
mental state can emerge

4887
03:02:11,910 --> 03:02:10,240
from configuration of the brain i've

4888
03:02:13,830 --> 03:02:11,920

i have a

4889

03:02:15,590 --> 03:02:13,840

a path that i can follow in fact many

4890

03:02:17,910 --> 03:02:15,600

people are following today this path i

4891

03:02:20,070 --> 03:02:17,920

mean there's a big

4892

03:02:21,670 --> 03:02:20,080

neuroscience

4893

03:02:23,990 --> 03:02:21,680

literature

4894

03:02:27,030 --> 03:02:24,000

very extremely interesting which is

4895

03:02:30,469 --> 03:02:27,040

precisely describing how

4896

03:02:34,389 --> 03:02:30,479

mental states add the notion of a self

4897

03:02:35,830 --> 03:02:34,399

um can emerge in a in a the complicated

4898

03:02:39,269 --> 03:02:35,840

uh sort of uh

4899

03:02:41,990 --> 03:02:39,279

neurological biological and evolutionary

4900

03:02:44,469 --> 03:02:42,000

story of our brain so

4901
03:02:46,469 --> 03:02:44,479
science allows us to make a story which

4902
03:02:49,190 --> 03:02:46,479
is incomplete but is in in in the

4903
03:02:51,590 --> 03:02:49,200
working about how mental state emerge in

4904
03:02:53,750 --> 03:02:51,600
the world in the same sense in which it

4905
03:02:55,510 --> 03:02:53,760
allows us to make a story in which how

4906
03:02:57,750 --> 03:02:55,520
is that a chair emerging the world i

4907
03:02:59,269 --> 03:02:57,760
mean how it's built by wood and and and

4908
03:03:01,670 --> 03:02:59,279
built by a civilization they want to sit

4909
03:03:04,389 --> 03:03:01,680
down and so on and so forth

4910
03:03:06,469 --> 03:03:04,399
while so so there's it can be done that

4911
03:03:08,309 --> 03:03:06,479
can be addressed by science

4912
03:03:10,630 --> 03:03:08,319
um

4913
03:03:11,510 --> 03:03:10,640

the the the the the

4914

03:03:14,230 --> 03:03:11,520

the

4915

03:03:20,309 --> 03:03:15,670

doesn't block science it's a sense to

4916

03:03:24,550 --> 03:03:23,190

perception or whatever and and and as i

4917

03:03:25,269 --> 03:03:24,560

described them

4918

03:03:26,870 --> 03:03:25,279

but

4919

03:03:29,750 --> 03:03:26,880

it doesn't allow

4920

03:03:32,630 --> 03:03:29,760

to do the same story to see how

4921

03:03:34,630 --> 03:03:32,640

um i can uh

4922

03:03:37,590 --> 03:03:34,640

out of a pure

4923

03:03:41,110 --> 03:03:39,030

state

4924

03:03:42,630 --> 03:03:41,120

necessarily

4925

03:03:44,389 --> 03:03:42,640

reconstruct the

4926

03:03:46,150 --> 03:03:44,399

the opposite world in other words

4927

03:03:48,469 --> 03:03:46,160

if i'm an idealistic

4928

03:03:50,070 --> 03:03:48,479

i don't have any other

4929

03:03:51,750 --> 03:03:50,080

scientific program except the ones

4930

03:03:54,469 --> 03:03:51,760

that's already there i can

4931

03:03:56,150 --> 03:03:54,479

describe chemistry physics but not the

4932

03:03:57,110 --> 03:03:56,160

relation between the mental and the

4933

03:04:00,389 --> 03:03:57,120

physical

4934

03:04:02,389 --> 03:04:00,399

well if i am a materialist in some wide

4935

03:04:04,710 --> 03:04:02,399

sense in large sense because narrow

4936

03:04:07,590 --> 03:04:04,720

material is most it doesn't work i mean

4937

03:04:10,230 --> 03:04:07,600

the world is not paid by stones

4938

03:04:12,309 --> 03:04:10,240

then i have an additional

4939

03:04:14,550 --> 03:04:12,319

program that i can do try to make sense

4940

03:04:17,429 --> 03:04:14,560

of mental state on the basis of physical

4941

03:04:21,510 --> 03:04:19,429

why can't an idealist say we can still

4942

03:04:23,590 --> 03:04:21,520

do that look instead of saying how does

4943

03:04:25,670 --> 03:04:23,600

mentality or how does mind states come

4944

03:04:27,429 --> 03:04:25,680

about from non-mine states like that's

4945

03:04:29,590 --> 03:04:27,439

essentially what you're saying before

4946

03:04:31,510 --> 03:04:29,600

why don't we just say well it's all

4947

03:04:33,990 --> 03:04:31,520

mind-like it's all pan-psychic in some

4948

03:04:35,750 --> 03:04:34,000

manner but certain configurations of

4949

03:04:37,190 --> 03:04:35,760

this mind state which

4950

03:04:39,110 --> 03:04:37,200

you can translate as matter certain

4951

03:04:41,190 --> 03:04:39,120

configurations of this matter

4952

03:04:43,349 --> 03:04:41,200

amplify the already existing

4953

03:04:46,790 --> 03:04:43,359

consciousness so you can still perform

4954

03:04:49,269 --> 03:04:46,800

neurobiology and neural correlates

4955

03:04:51,190 --> 03:04:49,279

in the same manner so why does thinking

4956

03:04:53,030 --> 03:04:51,200

of the world idealistically preclude

4957

03:04:54,630 --> 03:04:53,040

that i see it as just well you can just

4958

03:04:56,309 --> 03:04:54,640

say well we want to know what

4959

03:04:57,990 --> 03:04:56,319

configurations produce what states of

4960

03:04:58,950 --> 03:04:58,000

consciousness and what levels of

4961

03:05:09,190 --> 03:04:58,960

awareness and levels of

4962

03:05:12,389 --> 03:05:10,870

i don't know anybody in neuroscience and

4963

03:05:14,230 --> 03:05:12,399

thinks oh

4964

03:05:16,870 --> 03:05:14,240

no that's not true there are people in

4965

03:05:20,630 --> 03:05:16,880

neuroscience that may think that way

4966

03:05:22,309 --> 03:05:20,640

maybe tononi thinks in that way of um

4967

03:05:24,309 --> 03:05:22,319

any almost any of the theories of

4968

03:05:25,590 --> 03:05:24,319

consciousness that i've found

4969

03:05:27,349 --> 03:05:25,600

and i've been studying this for this

4970

03:05:28,790 --> 03:05:27,359

channel it's like

4971

03:05:30,389 --> 03:05:28,800

it can be applied to the universe and

4972

03:05:32,070 --> 03:05:30,399

then you find that there's some low

4973

03:05:34,230 --> 03:05:32,080

grade level of consciousness applied to

4974

03:05:36,550 --> 03:05:34,240

the universe as a whole anyway at least

4975

03:05:38,630 --> 03:05:36,560

tononi i think he's moving

4976

03:05:40,150 --> 03:05:38,640

in that direction i think he said that

4977

03:05:42,309 --> 03:05:40,160

his

4978

03:05:43,750 --> 03:05:42,319

it i believe it's called integrated

4979

03:05:46,150 --> 03:05:43,760

information theory

4980

03:05:47,429 --> 03:05:46,160

implies pan psychism in some weak sense

4981

03:05:49,590 --> 03:05:47,439

either way you understand what i was

4982

03:05:51,830 --> 03:05:49,600

saying before i so you were making the

4983

03:05:52,950 --> 03:05:51,840

claim that idealism precludes this

4984

03:05:54,790 --> 03:05:52,960

understanding of the brain and

4985

03:05:56,710 --> 03:05:54,800

neuroscience and so on but i was saying

4986

03:05:58,550 --> 03:05:56,720

i don't see it as necessarily precluding

4987

03:06:00,389 --> 03:05:58,560

it because you can still study and just

4988

03:06:02,870 --> 03:06:00,399

say why is it that this configuration of

4989

03:06:04,950 --> 03:06:02,880

matter read configuration of mind states

4990

03:06:13,110 --> 03:06:04,960

produce a larger mind state or a certain

4991

03:06:15,990 --> 03:06:14,950

yeah uh i hope you don't think i'm

4992

03:06:17,429 --> 03:06:16,000

fighting with you i'm just telling you

4993

03:06:19,910 --> 03:06:17,439

what occurs no no no no no of course of

4994

03:06:21,590 --> 03:06:19,920

course i know of course in fact

4995

03:06:23,429 --> 03:06:21,600

you're right and what you say um you're

4996

03:06:25,349 --> 03:06:23,439

probably right i

4997

03:06:27,030 --> 03:06:25,359

i maybe have not talked enough about

4998

03:06:28,790 --> 03:06:27,040

that um

4999

03:06:30,309 --> 03:06:28,800

you're you're

5000

03:06:31,830 --> 03:06:30,319

you're

5001
03:06:35,110 --> 03:06:31,840
breathing ideally is together with a

5002
03:06:36,790 --> 03:06:35,120
sort of pumped psychism right so you're

5003
03:06:39,429 --> 03:06:36,800
you're you you

5004
03:06:40,870 --> 03:06:39,439
you're taking this in this direction

5005
03:06:43,110 --> 03:06:40,880
here yeah that's some sort of pump

5006
03:06:50,630 --> 03:06:43,120
psychism stuff of that way

5007
03:06:53,990 --> 03:06:52,710
look

5008
03:06:58,389 --> 03:06:54,000
yeah

5009
03:07:01,030 --> 03:06:58,399
i'm not sure what it means uh

5010
03:07:02,070 --> 03:07:01,040
to be a very weak level

5011
03:07:03,510 --> 03:07:02,080
of

5012
03:07:05,750 --> 03:07:03,520
consciousness i mean i know what it

5013
03:07:08,389 --> 03:07:05,760

means in tony theory okay there's a

5014

03:07:11,830 --> 03:07:08,399

quantity called fee which have

5015

03:07:13,429 --> 03:07:11,840

big values in the brain and slow values

5016

03:07:16,309 --> 03:07:13,439

else

5017

03:07:21,030 --> 03:07:16,319

but that quantity has a

5018

03:07:26,070 --> 03:07:23,030

quantitative value

5019

03:07:29,910 --> 03:07:26,080

determined by configurations of matter

5020

03:07:32,790 --> 03:07:29,920

and the way matter might interact

5021

03:07:37,030 --> 03:07:32,800

so i know that jononi himself is a sort

5022

03:07:39,590 --> 03:07:37,040

of hidden secret idealist or

5023

03:07:42,230 --> 03:07:39,600

a little bit on psychist

5024

03:07:44,790 --> 03:07:42,240

but i'm not sure his theory is because

5025

03:07:46,550 --> 03:07:44,800

if his theory was

5026

03:07:47,349 --> 03:07:46,560

uh so

5027

03:07:51,990 --> 03:07:47,359

uh

5028

03:07:54,090 --> 03:07:52,000

it would not be possible to quantify

5029

03:07:55,269 --> 03:07:54,100

uh

5030

03:07:56,950 --> 03:07:55,279

[Music]

5031

03:07:59,590 --> 03:07:56,960

consciousness

5032

03:08:02,389 --> 03:07:59,600

on the basis of

5033

03:08:04,469 --> 03:08:02,399

a specific configuration of matter and

5034

03:08:06,309 --> 03:08:04,479

possibility of interaction of matter so

5035

03:08:08,150 --> 03:08:06,319

that was here's a ground there and the

5036

03:08:09,110 --> 03:08:08,160

ground is uh

5037

03:08:10,790 --> 03:08:09,120

uh

5038

03:08:12,630 --> 03:08:10,800

you know his physical system interacting

5039

03:08:14,710 --> 03:08:12,640

and affecting one another

5040

03:08:17,190 --> 03:08:14,720

and out of that he says in certain

5041

03:08:18,469 --> 03:08:17,200

configuration this

5042

03:08:20,230 --> 03:08:18,479

behave in a way that we call

5043

03:08:21,990 --> 03:08:20,240

consciousness

5044

03:08:23,750 --> 03:08:22,000

so i think his theory it's far more

5045

03:08:25,110 --> 03:08:23,760

materialistic that even what he would

5046

03:08:27,110 --> 03:08:25,120

like to think

5047

03:08:28,469 --> 03:08:27,120

remember i was saying i'm wondering oh

5048

03:08:30,309 --> 03:08:28,479

there's some way in which that's correct

5049

03:08:32,469 --> 03:08:30,319

some way in which that's correct we were

5050

03:08:34,070 --> 03:08:32,479

talking about this ecumenical quality

5051

03:08:37,670 --> 03:08:34,080

when it comes to what was his name

5052

03:08:39,750 --> 03:08:37,680

taloni right when it comes to tinona

5053

03:08:41,190 --> 03:08:39,760

now i know his theory isn't this

5054

03:08:43,429 --> 03:08:41,200

it's not as simple as let's imagine

5055

03:08:45,670 --> 03:08:43,439

billy balls and they bounce off one

5056

03:08:47,190 --> 03:08:45,680

another in certain

5057

03:08:48,630 --> 03:08:47,200

complex interactions these billiard

5058

03:08:50,309 --> 03:08:48,640

balls model and that creates

5059

03:08:52,150 --> 03:08:50,319

consciousness let's imagine it's but

5060

03:08:52,950 --> 03:08:52,160

let's imagine it's as simple as that

5061

03:08:54,309 --> 03:08:52,960

then

5062

03:08:55,830 --> 03:08:54,319

as you were saying

5063

03:08:57,910 --> 03:08:55,840

what's more fundamental the nodes or the

5064

03:09:00,469 --> 03:08:57,920

vertices sorry

5065

03:09:01,269 --> 03:09:00,479

the edges are the notes

5066

03:09:03,990 --> 03:09:01,279

well

5067

03:09:05,590 --> 03:09:04,000

then i'm wondering hmm imagine tononi's

5068

03:09:06,790 --> 03:09:05,600

was as simple as that that is as simple

5069

03:09:08,950 --> 03:09:06,800

as certain believe balls and they

5070

03:09:11,349 --> 03:09:08,960

interact so it's the relationship that

5071

03:09:13,349 --> 03:09:11,359

produces the consciousness and the balls

5072

03:09:14,630 --> 03:09:13,359

are fundamental but then earlier you

5073

03:09:16,630 --> 03:09:14,640

were saying well you can also view it as

5074

03:09:19,670 --> 03:09:16,640

the relationships are fundamental

5075

03:09:21,110 --> 03:09:19,680

so i'm wondering if in that sense

5076

03:09:22,790 --> 03:09:21,120

see the non-dualists don't like when i

5077

03:09:25,269 --> 03:09:22,800

say this i'm wondering if in some sense

5078

03:09:27,110 --> 03:09:25,279

physicalism and idealism

5079

03:09:29,429 --> 03:09:27,120

can be brought together as twin sides of

5080

03:09:31,990 --> 03:09:29,439

the same coin yes

5081

03:09:33,269 --> 03:09:32,000

yes it's a good point then

5082

03:09:34,469 --> 03:09:33,279

then the question is what we mean by

5083

03:09:37,750 --> 03:09:34,479

mental

5084

03:09:42,229 --> 03:09:37,760

uh

5085

03:09:45,030 --> 03:09:42,239

mind of

5086

03:09:47,590 --> 03:09:45,040

people like humans or maybe

5087

03:09:49,750 --> 03:09:47,600

mammals or maybe

5088

03:09:52,870 --> 03:09:49,760

um

5089

03:09:56,309 --> 03:09:53,750

all

5090

03:09:59,110 --> 03:09:56,319

animals with neural neurons which is

5091

03:10:00,229 --> 03:09:59,120

larger than mammals

5092

03:10:01,990 --> 03:10:00,239

then

5093

03:10:03,590 --> 03:10:02,000

i don't think this

5094

03:10:05,269 --> 03:10:03,600

might be sufficient to describe what

5095

03:10:07,429 --> 03:10:05,279

happened on a galaxy

5096

03:10:09,510 --> 03:10:07,439

if by mental

5097

03:10:11,670 --> 03:10:09,520

we mean something that

5098

03:10:13,830 --> 03:10:11,680

might go wrong everywhere even when

5099

03:10:15,670 --> 03:10:13,840

there are no animals no neurons nothing

5100

03:10:17,110 --> 03:10:15,680

like that

5101
03:10:19,750 --> 03:10:17,120
then

5102
03:10:21,590 --> 03:10:19,760
mental it's an extremely

5103
03:10:23,590 --> 03:10:21,600
vague notion

5104
03:10:26,550 --> 03:10:23,600
which i'm not sure what it means if not

5105
03:10:28,469 --> 03:10:26,560
just a vague analogy

5106
03:10:37,910 --> 03:10:28,479
that

5107
03:10:40,469 --> 03:10:37,920
uh because again um i think the naive

5108
03:10:42,870 --> 03:10:40,479
material is misfront i mean the the the

5109
03:10:46,469 --> 03:10:42,880
uh has been shown wrong by science the

5110
03:10:48,150 --> 03:10:46,479
the um sort of 18 19th century idea

5111
03:10:49,910 --> 03:10:48,160
that there's a perfectly

5112
03:10:51,830 --> 03:10:49,920
full description of the world in terms

5113
03:10:54,150 --> 03:10:51,840

of little stones moving and bouncing one

5114

03:10:56,630 --> 03:10:54,160

another pulled and pulled by forces

5115

03:10:58,229 --> 03:10:56,640

that's not science there's physics has

5116

03:11:00,150 --> 03:10:58,239

moved away from that

5117

03:11:01,670 --> 03:11:00,160

the the because of quantum mechanics

5118

03:11:03,349 --> 03:11:01,680

because of field theory because of

5119

03:11:04,229 --> 03:11:03,359

quantum field theory and so on and so

5120

03:11:06,389 --> 03:11:04,239

forth

5121

03:11:09,190 --> 03:11:06,399

uh so the world is far more complicated

5122

03:11:10,550 --> 03:11:09,200

than that and if if you take if in

5123

03:11:12,630 --> 03:11:10,560

particular you take

5124

03:11:14,229 --> 03:11:12,640

ratio quantum mechanics

5125

03:11:16,309 --> 03:11:14,239

seriously

5126
03:11:18,950 --> 03:11:16,319
you think in terms of relations and how

5127
03:11:22,630 --> 03:11:18,960
things affect one another

5128
03:11:24,870 --> 03:11:22,640
now you want to call this relative uh

5129
03:11:27,510 --> 03:11:24,880
properties mental

5130
03:11:29,830 --> 03:11:27,520
you might but then it's a name

5131
03:11:32,870 --> 03:11:29,840
it's a name which is uh

5132
03:11:33,990 --> 03:11:32,880
i don't see what happened what adds

5133
03:11:35,510 --> 03:11:34,000
um

5134
03:11:36,389 --> 03:11:35,520
to the

5135
03:11:38,550 --> 03:11:36,399
uh

5136
03:11:42,070 --> 03:11:38,560
to our understanding

5137
03:11:46,229 --> 03:11:44,070
and and what

5138
03:11:48,229 --> 03:11:46,239

interpreting this

5139

03:11:49,990 --> 03:11:48,239

so that was i think i'm an amonist

5140

03:11:52,630 --> 03:11:50,000

modest in the sense that i don't think

5141

03:11:54,389 --> 03:11:52,640

they're two different kind of phenomena

5142

03:11:56,229 --> 03:11:54,399

i'm a monies like in the sense of

5143

03:11:57,750 --> 03:11:56,239

bertrand russell they're mental

5144

03:11:59,990 --> 03:11:57,760

phenomena and there are physical

5145

03:12:01,910 --> 03:12:00,000

phenomena mental phenomena you say oh i

5146

03:12:04,150 --> 03:12:01,920

see white and there's a physical

5147

03:12:06,950 --> 03:12:04,160

phenomena that there's a thing moving

5148

03:12:10,229 --> 03:12:06,960

down there i think this whole phenomena

5149

03:12:12,630 --> 03:12:10,239

they all belong to the same beat class

5150

03:12:14,150 --> 03:12:12,640

that should be explained by we we

5151
03:12:15,590 --> 03:12:14,160
understand more and more about all of

5152
03:12:16,790 --> 03:12:15,600
them but they're not two different

5153
03:12:19,269 --> 03:12:16,800
worlds

5154
03:12:21,670 --> 03:12:19,279
so if you're telling me look at some

5155
03:12:23,750 --> 03:12:21,680
elementary level of this distinct

5156
03:12:25,349 --> 03:12:23,760
very very very general way of just

5157
03:12:27,269 --> 03:12:25,359
understanding about the world we have

5158
03:12:29,269 --> 03:12:27,279
the distinction between the two

5159
03:12:30,150 --> 03:12:29,279
evaporates i'm happy

5160
03:12:33,110 --> 03:12:30,160
yeah

5161
03:12:35,990 --> 03:12:33,120
but is that idealism at this point

5162
03:12:38,070 --> 03:12:36,000
idealism is a strong way of reducing one

5163
03:12:40,550 --> 03:12:38,080

to the other

5164

03:12:42,550 --> 03:12:40,560

uh like you know

5165

03:12:44,870 --> 03:12:42,560

old 19th century materialism is a strong

5166

03:12:46,630 --> 03:12:44,880

way of reducing one to the other

5167

03:12:47,429 --> 03:12:46,640

um

5168

03:12:48,870 --> 03:12:47,439

yeah

5169

03:12:50,790 --> 03:12:48,880

have you thought much about the heart

5170

03:12:51,910 --> 03:12:50,800

problem of consciousness

5171

03:12:54,070 --> 03:12:51,920

yeah

5172

03:12:56,550 --> 03:12:54,080

so what do you believe exist

5173

03:12:58,469 --> 03:12:56,560

all right let's hear it's a confusion

5174

03:13:00,550 --> 03:12:58,479

i think it's a confusion my my take on

5175

03:13:03,670 --> 03:13:00,560

the half problem of consciousness this

5176

03:13:06,389 --> 03:13:03,680

is david chalmer uh

5177

03:13:08,469 --> 03:13:06,399

is that if you reach almost the point is

5178

03:13:09,990 --> 03:13:08,479

about we believe that

5179

03:13:12,870 --> 03:13:10,000

there is a hard problem of consciousness

5180

03:13:14,389 --> 03:13:12,880

because it is conceivable for us say to

5181

03:13:15,670 --> 03:13:14,399

think there is a zombie

5182

03:13:18,389 --> 03:13:15,680

right so it seems there is the same

5183

03:13:19,830 --> 03:13:18,399

physical configuration but nobody inside

5184

03:13:21,750 --> 03:13:19,840

and that shows

5185

03:13:24,469 --> 03:13:21,760

that even if we understand the physics

5186

03:13:26,950 --> 03:13:24,479

completely there is something missing

5187

03:13:29,750 --> 03:13:26,960

so this is based on what is conceivable

5188

03:13:32,309 --> 03:13:29,760

to us so the problem of

5189

03:13:35,349 --> 03:13:32,319

the heart from your consciousness

5190

03:13:37,190 --> 03:13:35,359

it's a problem that comes from taking

5191

03:13:39,910 --> 03:13:37,200

the strong

5192

03:13:42,870 --> 03:13:39,920

what we find conceivable not conceivable

5193

03:13:46,150 --> 03:13:42,880

so the kind of uh

5194

03:13:48,309 --> 03:13:46,160

intuition where the world view right now

5195

03:13:50,070 --> 03:13:48,319

but the kind of intuition that we have

5196

03:13:52,309 --> 03:13:50,080

about the world view right now is

5197

03:13:56,229 --> 03:13:52,319

exactly the kind of thing that science

5198

03:13:57,670 --> 03:13:56,239

shows wrong every step of the way

5199

03:13:58,389 --> 03:13:57,680

so

5200

03:14:02,309 --> 03:13:58,399

the

5201

03:14:03,910 --> 03:14:02,319

that we have some wrong intuition

5202

03:14:06,150 --> 03:14:03,920

because nature

5203

03:14:07,910 --> 03:14:06,160

has produced us

5204

03:14:10,790 --> 03:14:07,920

by solving the easy problem of caution

5205

03:14:12,389 --> 03:14:10,800

is not the half of consciousness so um

5206

03:14:14,309 --> 03:14:12,399

the easy problem of consciousness of

5207

03:14:16,070 --> 03:14:14,319

course is very hard which is how the

5208

03:14:18,309 --> 03:14:16,080

brain works

5209

03:14:20,950 --> 03:14:18,319

but i am deeply convinced that if you

5210

03:14:22,070 --> 03:14:20,960

take a copy of me

5211

03:14:23,110 --> 03:14:22,080

okay

5212

03:14:25,990 --> 03:14:23,120

equal

5213

03:14:26,870 --> 03:14:26,000

same nose same hair

5214

03:14:36,309 --> 03:14:26,880

same

5215

03:14:37,590 --> 03:14:36,319

conscious it's just no way for me to

5216

03:14:39,429 --> 03:14:37,600

conceive

5217

03:14:41,190 --> 03:14:39,439

that i could be conscious and the copy

5218

03:14:43,349 --> 03:14:41,200

of me could be non-conscious so

5219

03:14:44,950 --> 03:14:43,359

therefore if we understand how the thing

5220

03:14:48,469 --> 03:14:44,960

works we understand what it means what

5221

03:14:49,990 --> 03:14:48,479

i'm saying when i'm saying i'm conscious

5222

03:14:51,269 --> 03:14:50,000

i don't believe there's a

5223

03:14:53,349 --> 03:14:51,279

hard problem of consciousness i think

5224

03:14:54,950 --> 03:14:53,359

there's a very hard easy problem of

5225

03:14:57,670 --> 03:14:54,960

consciousness namely

5226

03:14:58,550 --> 03:14:57,680

com understanding this uh this uh

5227

03:15:01,830 --> 03:14:58,560

you see

5228

03:15:03,750 --> 03:15:01,840

we don't understand

5229

03:15:06,550 --> 03:15:03,760

well if you if you if you talk to people

5230

03:15:08,550 --> 03:15:06,560

doing climate science or meteorological

5231

03:15:11,269 --> 03:15:08,560

science not climate science

5232

03:15:12,389 --> 03:15:11,279

a thunderstorm is not yet understood

5233

03:15:13,670 --> 03:15:12,399

it's very complicated phenomena to

5234

03:15:15,590 --> 03:15:13,680

understand because there's electric

5235

03:15:18,630 --> 03:15:15,600

things magnetic thing chemical thing

5236

03:15:20,630 --> 03:15:18,640

it's all sort of rapid and

5237

03:15:22,790 --> 03:15:20,640

hydrodynamics is horrendously

5238

03:15:26,389 --> 03:15:22,800

complicated so what exactly happened

5239

03:15:28,229 --> 03:15:26,399

with thunderstorm is not understood okay

5240

03:15:30,950 --> 03:15:28,239

does this mean that it's a hard problem

5241

03:15:33,750 --> 03:15:30,960

of thunderstorms no it means that this

5242

03:15:35,830 --> 03:15:33,760

complicated thing okay does it mean that

5243

03:15:37,990 --> 03:15:35,840

it's jupiter

5244

03:15:40,710 --> 03:15:38,000

you know the the the flashes the the

5245

03:15:42,870 --> 03:15:40,720

lightnings are the rage of jupiter i

5246

03:15:44,630 --> 03:15:42,880

mean no you don't think there's jupiter

5247

03:15:45,990 --> 03:15:44,640

there i think they just don't understand

5248

03:15:47,190 --> 03:15:46,000

what's going on

5249

03:15:49,910 --> 03:15:47,200

so i see

5250

03:15:52,070 --> 03:15:49,920

i don't see the difference between

5251
03:15:53,990 --> 03:15:52,080
thunderstorms and

5252
03:15:55,510 --> 03:15:54,000
uh

5253
03:15:58,710 --> 03:15:55,520
the human mind

5254
03:16:01,910 --> 03:16:00,070
let me see if i understand this

5255
03:16:03,830 --> 03:16:01,920
correctly if we were to imagine

5256
03:16:05,429 --> 03:16:03,840
duplicating you

5257
03:16:06,630 --> 03:16:05,439
then

5258
03:16:09,990 --> 03:16:06,640
you don't know

5259
03:16:10,950 --> 03:16:10,000
or it's unclear how that duplicate

5260
03:16:15,510 --> 03:16:10,960
would be

5261
03:16:18,790 --> 03:16:17,670
uh the reason i'm saying is that because

5262
03:16:21,590 --> 03:16:18,800
uh

5263
03:16:23,670 --> 03:16:21,600

chalmers one of the strong arguments

5264

03:16:25,750 --> 03:16:23,680

for the existence of the

5265

03:16:27,030 --> 03:16:25,760

hard form of consciousness

5266

03:16:29,349 --> 03:16:27,040

in his book

5267

03:16:31,670 --> 03:16:29,359

is to say well imagine you have a zombie

5268

03:16:32,550 --> 03:16:31,680

a zombie is somebody that believes like

5269

03:16:44,710 --> 03:16:32,560

me

5270

03:16:46,870 --> 03:16:44,720

including down to the atomic level

5271

03:16:49,110 --> 03:16:46,880

but there is no consciousness so he says

5272

03:16:51,030 --> 03:16:49,120

imagine this thing okay

5273

03:16:52,870 --> 03:16:51,040

and look if you can imagine that it

5274

03:16:55,030 --> 03:16:52,880

means you can imagine that consciousness

5275

03:16:57,190 --> 03:16:55,040

is separated from the physical something

5276

03:16:59,349 --> 03:16:57,200

else something above the physical

5277

03:17:01,190 --> 03:16:59,359

because you can have the same physical

5278

03:17:02,389 --> 03:17:01,200

with or without consciousness so this

5279

03:17:04,950 --> 03:17:02,399

proves it

5280

03:17:06,790 --> 03:17:04,960

so he proves that constantly something

5281

03:17:08,309 --> 03:17:06,800

separate from the physical

5282

03:17:10,630 --> 03:17:08,319

on the basis

5283

03:17:13,269 --> 03:17:10,640

of this zombie argument think that there

5284

03:17:15,590 --> 03:17:13,279

is a copy of you um

5285

03:17:17,590 --> 03:17:15,600

which is uh there's nobody inside

5286

03:17:19,990 --> 03:17:17,600

there's no self person

5287

03:17:22,150 --> 03:17:20,000

but they think there was

5288

03:17:23,349 --> 03:17:22,160

exactly me i wouldn't understand what it

5289

03:17:26,070 --> 03:17:23,359

means there's nobody inside they could

5290

03:17:28,150 --> 03:17:26,080

talk to him hey carlo how how do you

5291

03:17:29,830 --> 03:17:28,160

feel i mean i'm the right one or you're

5292

03:17:31,910 --> 03:17:29,840

the right one he could fight about that

5293

03:17:33,590 --> 03:17:31,920

and you know make jokes about that

5294

03:17:35,510 --> 03:17:33,600

of course it wouldn't make any sense to

5295

03:17:36,469 --> 03:17:35,520

know which ones the right and which ones

5296

03:17:37,910 --> 03:17:36,479

are false

5297

03:17:40,630 --> 03:17:37,920

um

5298

03:17:42,070 --> 03:17:40,640

so he would be conscious under all

5299

03:17:43,349 --> 03:17:42,080

possible

5300

03:17:45,990 --> 03:17:43,359

way that i couldn't understand

5301

03:17:48,150 --> 03:17:46,000

consciousness so his proof is based on

5302

03:17:50,309 --> 03:17:48,160

an intuition that i don't have

5303

03:17:53,030 --> 03:17:50,319

the existence of zombies have you ever

5304

03:17:55,510 --> 03:17:53,040

played virtual reality

5305

03:17:57,990 --> 03:17:55,520

like put on a vr headset yeah yeah a bit

5306

03:17:59,590 --> 03:17:58,000

a little bit yeah okay the reason why is

5307

03:18:01,510 --> 03:17:59,600

i don't find it so inconceivable i can

5308

03:18:03,429 --> 03:18:01,520

imagine putting on a vr headset and

5309

03:18:05,830 --> 03:18:03,439

seeing my wife or seeing you or even

5310

03:18:07,670 --> 03:18:05,840

myself and even being able to look in

5311

03:18:10,150 --> 03:18:07,680

someone's brain and it's generated with

5312

03:18:13,830 --> 03:18:10,160

a computer of course i would have no id

5313

03:18:17,030 --> 03:18:15,510

what's the word procedurally generate so

5314

03:18:18,870 --> 03:18:17,040

we can procedurally generate the brain

5315

03:18:20,229 --> 03:18:18,880

as i zoom in and zoom out i can't even

5316

03:18:21,590 --> 03:18:20,239

do that physically like i can't zoom

5317

03:18:23,750 --> 03:18:21,600

into your brain physically but

5318

03:18:26,870 --> 03:18:23,760

regardless i don't see it as totally

5319

03:18:29,590 --> 03:18:26,880

inconceivable that there can be this

5320

03:18:31,590 --> 03:18:29,600

simulated copy that it itself we would

5321

03:18:34,309 --> 03:18:31,600

say is not conscious and it can talk i

5322

03:18:36,070 --> 03:18:34,319

can touch it and see the blood fall out

5323

03:18:37,750 --> 03:18:36,080

from wherever i'm touching with my

5324

03:18:39,990 --> 03:18:37,760

scissors or whatever maybe

5325

03:18:43,190 --> 03:18:40,000

why is it inconceivable to consider a

5326
03:18:46,710 --> 03:18:45,510
even in vr

5327
03:18:49,670 --> 03:18:46,720
well

5328
03:18:52,469 --> 03:18:49,680
let's let's push it if in vr

5329
03:18:54,630 --> 03:18:52,479
you could uh

5330
03:18:56,389 --> 03:18:54,640
create a person

5331
03:18:58,389 --> 03:18:56,399
and this person doesn't just look like a

5332
03:19:00,710 --> 03:18:58,399
person and you touch him and and blood

5333
03:19:04,710 --> 03:19:00,720
comes out but also answer your questions

5334
03:19:08,870 --> 03:19:04,720
and also have a memory and also have a

5335
03:19:10,790 --> 03:19:08,880
a way of reflecting and everything and

5336
03:19:12,550 --> 03:19:10,800
and blah blah blah blah blah and

5337
03:19:13,510 --> 03:19:12,560
all the memories and all the complexity

5338
03:19:16,630 --> 03:19:13,520

of me

5339

03:19:19,110 --> 03:19:16,640

i think that whatever computer

5340

03:19:21,830 --> 03:19:19,120

is implementing all that

5341

03:19:24,389 --> 03:19:21,840

you know it has memory it talks about i

5342

03:19:25,750 --> 03:19:24,399

i remember that i'm this i'm that i see

5343

03:19:27,269 --> 03:19:25,760

you

5344

03:19:29,030 --> 03:19:27,279

that's his

5345

03:19:29,990 --> 03:19:29,040

a real person how about let's remove the

5346

03:19:31,269 --> 03:19:30,000

memory and the reflective

5347

03:19:32,870 --> 03:19:31,279

characteristics because there's some

5348

03:19:35,269 --> 03:19:32,880

people who are have are mentally

5349

03:19:37,429 --> 03:19:35,279

challenged by birth they cannot develop

5350

03:19:38,790 --> 03:19:37,439

a reflective property

5351

03:19:40,550 --> 03:19:38,800

even babies

5352

03:19:46,309 --> 03:19:40,560

so let's imagine that we would say a

5353

03:19:49,590 --> 03:19:47,990

a baby has no memories let's imagine

5354

03:19:57,269 --> 03:19:49,600

this this baby has no memory so let's

5355

03:19:57,279 --> 03:20:01,110

uh

5356

03:20:03,830 --> 03:20:02,150

i'm attacking i'm just telling you what

5357

03:20:05,429 --> 03:20:03,840

occurs to me i'm sorry no no no of

5358

03:20:07,190 --> 03:20:05,439

course i like it

5359

03:20:07,570 --> 03:20:07,200

i like this

5360

03:20:09,349 --> 03:20:07,580

um

5361

03:20:10,710 --> 03:20:09,359

[Music]

5362

03:20:12,710 --> 03:20:10,720

okay so

5363

03:20:15,830 --> 03:20:12,720

feeling

5364

03:20:17,990 --> 03:20:15,840

it's uh um philosophical babies instead

5365

03:20:19,590 --> 03:20:18,000

of philosophical zombies just the zombie

5366

03:20:21,429 --> 03:20:19,600

babies

5367

03:20:24,469 --> 03:20:21,439

so you mentioned memory and reflective

5368

03:20:27,110 --> 03:20:24,479

capabilities i'm just saying remove that

5369

03:20:28,870 --> 03:20:27,120

right so um

5370

03:20:29,670 --> 03:20:28,880

i think that uh

5371

03:20:32,550 --> 03:20:29,680

uh

5372

03:20:33,670 --> 03:20:32,560

let's separate the question in into if

5373

03:20:37,349 --> 03:20:33,680

you

5374

03:20:39,590 --> 03:20:37,359

uh so let's forget virtual reality for a

5375

03:20:41,750 --> 03:20:39,600

moment if you have a

5376

03:20:44,870 --> 03:20:41,760

um

5377

03:20:49,590 --> 03:20:48,070

an artificial baby

5378

03:20:53,830 --> 03:20:49,600

um

5379

03:20:55,590 --> 03:20:53,840

that behaves like a baby and uh and uh

5380

03:20:58,630 --> 03:20:55,600

in all the complexity of a baby i think

5381

03:21:00,229 --> 03:20:58,640

it's soft it suffers it would suffer

5382

03:21:02,309 --> 03:21:00,239

i would not hurt

5383

03:21:06,950 --> 03:21:02,319

it

5384

03:21:10,229 --> 03:21:06,960

of course

5385

03:21:12,229 --> 03:21:10,239

if you give me a little robot

5386

03:21:13,349 --> 03:21:12,239

which when are you kicking he says wow

5387

03:21:15,269 --> 03:21:13,359

yeah okay

5388

03:21:17,429 --> 03:21:15,279

i will kick it because i know that

5389

03:21:19,670 --> 03:21:17,439

there's a huge difference between that

5390

03:21:21,429 --> 03:21:19,680

robot and a baby but is the actual

5391

03:21:22,710 --> 03:21:21,439

difference

5392

03:21:24,870 --> 03:21:22,720

that

5393

03:21:25,830 --> 03:21:24,880

uh establish

5394

03:21:29,349 --> 03:21:25,840

my

5395

03:21:30,790 --> 03:21:29,359

that there is suffering always not afro

5396

03:21:32,950 --> 03:21:30,800

suffering

5397

03:21:34,710 --> 03:21:32,960

if if it would uh

5398

03:21:36,150 --> 03:21:34,720

because i think that suffering is

5399

03:21:37,670 --> 03:21:36,160

nothing else

5400

03:21:39,990 --> 03:21:37,680

then just you know

5401
03:21:42,389 --> 03:21:40,000
the the baby having a ball a body a

5402
03:21:46,710 --> 03:21:42,399
brain and and and all these things and

5403
03:21:48,950 --> 03:21:47,750
uh

5404
03:21:53,830 --> 03:21:48,960
so

5405
03:21:55,670 --> 03:21:53,840
this is a full story or a real story but

5406
03:21:57,990 --> 03:21:55,680
he he believed that only humans have

5407
03:21:59,750 --> 03:21:58,000
consciousness he would kick his dog

5408
03:22:02,710 --> 03:21:59,760
because he thought that uh

5409
03:22:04,229 --> 03:22:02,720
i don't know if he's true uh because i i

5410
03:22:06,630 --> 03:22:04,239
read that he was very attached to his

5411
03:22:09,110 --> 03:22:06,640
dog so just the things that things

5412
03:22:10,309 --> 03:22:09,120
wouldn't wouldn't go together well

5413
03:22:12,469 --> 03:22:10,319

um

5414

03:22:14,630 --> 03:22:12,479

but if he if it is true i think it was a

5415

03:22:19,590 --> 03:22:14,640

mistake i don't think there is any

5416

03:22:23,750 --> 03:22:22,550

real as a mental state than a human

5417

03:22:25,910 --> 03:22:23,760

suffering

5418

03:22:26,950 --> 03:22:25,920

i mean we we might prefer killing a dog

5419

03:22:29,110 --> 03:22:26,960

than killing a man but that's a

5420

03:22:31,590 --> 03:22:29,120

different story

5421

03:22:32,950 --> 03:22:31,600

now the virtual reality simulation of

5422

03:22:36,070 --> 03:22:32,960

pain

5423

03:22:38,550 --> 03:22:36,080

you're right that's more tricky

5424

03:22:45,110 --> 03:22:40,630

because

5425

03:22:49,349 --> 03:22:46,710

you have a software

5426
03:22:50,469 --> 03:22:49,359
that simulate the entire body of the as

5427
03:22:52,309 --> 03:22:50,479
a body

5428
03:22:54,150 --> 03:22:52,319
uh

5429
03:22:55,190 --> 03:22:54,160
being hurt and suffering that i don't

5430
03:22:57,349 --> 03:22:55,200
know

5431
03:22:59,990 --> 03:22:57,359
that's just bustling okay now rapid fire

5432
03:23:02,550 --> 03:23:00,000
again just a few more so this nickel

5433
03:23:04,150 --> 03:23:02,560
ns and he wrote the word he or she wrote

5434
03:23:06,309 --> 03:23:04,160
the word phi econ i don't know if that

5435
03:23:07,429 --> 03:23:06,319
means physics economist

5436
03:23:09,110 --> 03:23:07,439
regardless

5437
03:23:11,110 --> 03:23:09,120
here she said i want to thank carlo

5438
03:23:13,590 --> 03:23:11,120

robelli a lot when i was doing my

5439

03:23:15,910 --> 03:23:13,600

masters 14 years ago i ended up with a

5440

03:23:17,269 --> 03:23:15,920

similar idea as relational quantum

5441

03:23:19,269 --> 03:23:17,279

mechanics but i didn't have the

5442

03:23:21,269 --> 03:23:19,279

mathematical ability to pursue it and

5443

03:23:23,750 --> 03:23:21,279

i've been following him since question

5444

03:23:26,070 --> 03:23:23,760

one what is his view regarding the paper

5445

03:23:30,790 --> 03:23:26,080

quantum principle of relativity by

5446

03:23:33,030 --> 03:23:30,800

andres dragon and artur eckert

5447

03:23:34,950 --> 03:23:33,040

are you aware of that paper

5448

03:23:37,190 --> 03:23:34,960

quantum principle well thank you thank

5449

03:23:39,750 --> 03:23:37,200

you for watching she says no i'm sorry

5450

03:23:41,830 --> 03:23:39,760

i'm not aware of this paper so um

5451

03:23:44,070 --> 03:23:41,840

if if he or she thinks it's interesting

5452

03:23:46,150 --> 03:23:44,080

send me an email and i'm gonna read it i

5453

03:23:47,750 --> 03:23:46,160

will send it to you his question or her

5454

03:23:53,830 --> 03:23:47,760

question number two is what is his view

5455

03:24:00,389 --> 03:23:54,710

uh

5456

03:24:01,590 --> 03:24:00,399

this is brian swingle i don't know i

5457

03:24:03,910 --> 03:24:01,600

don't know if that's a physicist i don't

5458

03:24:06,469 --> 03:24:03,920

know who that is i'm sorry

5459

03:24:09,110 --> 03:24:06,479

i'm sorry i don't know same okay good

5460

03:24:11,510 --> 03:24:09,120

sir knight i love carlo a great man to

5461

03:24:13,910 --> 03:24:11,520

explain complex ideas simply to a person

5462

03:24:15,590 --> 03:24:13,920

like myself he said before that he took

5463

03:24:16,950 --> 03:24:15,600

psychedelics when he was young i think

5464

03:24:19,269 --> 03:24:16,960

it was lsd

5465

03:24:21,590 --> 03:24:19,279

and it was a satori moment which helped

5466

03:24:23,910 --> 03:24:21,600

him think about time in physics in novel

5467

03:24:26,150 --> 03:24:23,920

ways has he done psychedelics since and

5468

03:24:30,389 --> 03:24:26,160

if so has it given him any new insights

5469

03:24:34,229 --> 03:24:32,630

um at this psychedelic said in my youth

5470

03:24:36,870 --> 03:24:34,239

a few times

5471

03:24:37,670 --> 03:24:36,880

ten times maybe uh no more

5472

03:24:39,590 --> 03:24:37,680

uh

5473

03:24:43,590 --> 03:24:39,600

15 maybe um

5474

03:24:50,309 --> 03:24:46,790

done it since uh and i don't know maybe

5475

03:24:51,269 --> 03:24:50,319

i i will in the future um nowadays

5476
03:24:52,469 --> 03:24:51,279
things

5477
03:24:53,990 --> 03:24:52,479
so what the whole thing about

5478
03:24:55,429 --> 03:24:54,000
psychedelics is changing it's changing

5479
03:24:56,870 --> 03:24:55,439
very rapidly

5480
03:25:00,070 --> 03:24:56,880
so

5481
03:25:01,429 --> 03:25:00,080
things might become simpler uh now

5482
03:25:04,229 --> 03:25:01,439
um

5483
03:25:05,269 --> 03:25:04,239
it was important for me it was a very

5484
03:25:06,790 --> 03:25:05,279
strong

5485
03:25:13,750 --> 03:25:06,800
experience like

5486
03:25:13,760 --> 03:25:20,070
do you recall your dosage

5487
03:25:24,229 --> 03:25:21,190
no

5488
03:25:25,510 --> 03:25:24,239

um but comparing to descriptions uh

5489

03:25:28,070 --> 03:25:25,520

which you find in literature was

5490

03:25:30,150 --> 03:25:28,080

certainly quite high oh yeah

5491

03:25:31,750 --> 03:25:30,160

wow yeah

5492

03:25:33,510 --> 03:25:31,760

yeah uh

5493

03:25:35,110 --> 03:25:33,520

definitely high um

5494

03:25:38,309 --> 03:25:35,120

i mean

5495

03:25:40,389 --> 03:25:38,319

compared to the strongest uh

5496

03:25:41,830 --> 03:25:40,399

accounts of of of

5497

03:25:43,590 --> 03:25:41,840

similar experience that you find

5498

03:25:46,150 --> 03:25:43,600

nowadays easily

5499

03:25:48,389 --> 03:25:46,160

in in all sorts of literature

5500

03:25:49,670 --> 03:25:48,399

um

5501
03:25:51,750 --> 03:25:49,680
you know

5502
03:25:54,710 --> 03:25:51,760
steve jobs the the head

5503
03:25:57,349 --> 03:25:54,720
of apple said that to take lsd this

5504
03:25:59,830 --> 03:25:57,359
youth was one of the two most important

5505
03:26:01,590 --> 03:25:59,840
strong experiences of his life i i think

5506
03:26:03,110 --> 03:26:01,600
i could subscribe that it was very

5507
03:26:06,469 --> 03:26:03,120
strong

5508
03:26:08,710 --> 03:26:06,479
um it definitely did not i did not

5509
03:26:09,830 --> 03:26:08,720
get direct physical ideas by taking nst

5510
03:26:11,670 --> 03:26:09,840
so i don't

5511
03:26:13,349 --> 03:26:11,680
suggest you know take lsd so you write

5512
03:26:14,469 --> 03:26:13,359
good paper in physics that's not the way

5513
03:26:17,190 --> 03:26:14,479

it works

5514

03:26:19,670 --> 03:26:17,200

um i was young and it was many many

5515

03:26:22,229 --> 03:26:19,680

years from there to the actual physics

5516

03:26:25,110 --> 03:26:22,239

uh i did however

5517

03:26:27,910 --> 03:26:25,120

i believe it's true that

5518

03:26:31,030 --> 03:26:27,920

it did affect

5519

03:26:35,550 --> 03:26:31,040

my way of thinking about reality

5520

03:26:38,630 --> 03:26:35,560

especially um in a sort of uh

5521

03:26:41,269 --> 03:26:38,640

liberatory sense i mean thought about i

5522

03:26:43,830 --> 03:26:41,279

came out i was young again i was

5523

03:26:45,750 --> 03:26:43,840

i guess the first time i was 16.

5524

03:26:47,830 --> 03:26:45,760

i came out with from that experience

5525

03:26:50,150 --> 03:26:47,840

saying thinking wait a minute what we

5526
03:26:52,710 --> 03:26:50,160
usually think about space and time and

5527
03:26:54,550 --> 03:26:52,720
matter and energy and mind and me and

5528
03:26:55,510 --> 03:26:54,560
the world and that

5529
03:26:57,349 --> 03:26:55,520
uh

5530
03:26:59,190 --> 03:26:57,359
that's just one way of thinking about

5531
03:27:01,110 --> 03:26:59,200
things maybe there are all sorts of

5532
03:27:03,670 --> 03:27:01,120
other ways of thinking about that and my

5533
03:27:05,830 --> 03:27:03,680
brain is can can view things

5534
03:27:08,150 --> 03:27:05,840
very very differently for a while so it

5535
03:27:09,110 --> 03:27:08,160
might be possible to think differently

5536
03:27:11,349 --> 03:27:09,120
so

5537
03:27:14,870 --> 03:27:11,359
i came out from that experience maybe it

5538
03:27:16,790 --> 03:27:14,880

was also the culture at the time

5539

03:27:19,830 --> 03:27:16,800

with an extremely

5540

03:27:21,269 --> 03:27:19,840

large a purely flexibility

5541

03:27:23,429 --> 03:27:21,279

about

5542

03:27:24,870 --> 03:27:23,439

possibilities right right i can imagine

5543

03:27:26,550 --> 03:27:24,880

that

5544

03:27:29,349 --> 03:27:26,560

in terms of you know political ideas

5545

03:27:33,429 --> 03:27:29,359

moral ideas social ideas

5546

03:27:36,389 --> 03:27:33,439

but also physical idea i mean i

5547

03:27:38,630 --> 03:27:36,399

i had a distinctive sense that this

5548

03:27:40,630 --> 03:27:38,640

organization in space and in time that

5549

03:27:42,389 --> 03:27:40,640

we

5550

03:27:44,469 --> 03:27:42,399

usually perceive about the world could

5551

03:27:46,710 --> 03:27:44,479

just change with a little chemical

5552

03:27:48,790 --> 03:27:46,720

so we are clinical so

5553

03:27:50,229 --> 03:27:48,800

you know why should one be better than

5554

03:27:51,269 --> 03:27:50,239

the other

5555

03:27:52,950 --> 03:27:51,279

um

5556

03:27:54,630 --> 03:27:52,960

and this stayed with me

5557

03:27:55,510 --> 03:27:54,640

and i think that one

5558

03:27:57,910 --> 03:27:55,520

first

5559

03:28:00,950 --> 03:27:57,920

it gave me curiosity

5560

03:28:02,870 --> 03:28:00,960

because when i later on 10 years later

5561

03:28:04,309 --> 03:28:02,880

i studied physics

5562

03:28:06,550 --> 03:28:04,319

and read that you know einstein

5563

03:28:08,070 --> 03:28:06,560

discovered that simultaneity is not

5564

03:28:10,950 --> 03:28:08,080

well defined

5565

03:28:12,710 --> 03:28:10,960

i said well about it this i you know i

5566

03:28:14,150 --> 03:28:12,720

do i knew that things were more

5567

03:28:15,349 --> 03:28:14,160

complicated than what they looked at the

5568

03:28:17,510 --> 03:28:15,359

first side

5569

03:28:20,309 --> 03:28:17,520

um and then when i studied generativity

5570

03:28:22,389 --> 03:28:20,319

quantum mechanics i was ready to accept

5571

03:28:24,550 --> 03:28:22,399

very easily the idea

5572

03:28:26,150 --> 03:28:24,560

uh that the world could perhaps be

5573

03:28:28,389 --> 03:28:26,160

profoundly different than i would

5574

03:28:29,830 --> 03:28:28,399

imagine of it didn't scare me the idea

5575

03:28:32,309 --> 03:28:29,840

because somehow it's an idea that had

5576

03:28:35,190 --> 03:28:32,319

confronted so in that sense i think it

5577

03:28:37,110 --> 03:28:35,200

was very useful um for this no more than

5578

03:28:39,269 --> 03:28:37,120

that

5579

03:28:40,389 --> 03:28:39,279

did you get to a state of a temporality

5580

03:28:43,269 --> 03:28:40,399

where you didn't feel like there was

5581

03:28:46,150 --> 03:28:43,279

time passing yeah or eternity even like

5582

03:28:46,950 --> 03:28:46,160

infinite time passing yeah that's one of

5583

03:28:47,670 --> 03:28:46,960

the

5584

03:28:50,150 --> 03:28:47,680

uh

5585

03:28:51,030 --> 03:28:50,160

i say more common

5586

03:28:52,870 --> 03:28:51,040

um

5587

03:28:56,790 --> 03:28:52,880

things that people say

5588

03:28:58,550 --> 03:28:56,800

namely that uh time it's uh uh the sense

5589

03:28:59,750 --> 03:28:58,560

of time is completely

5590

03:29:02,229 --> 03:28:59,760

uh

5591

03:29:04,710 --> 03:29:02,239

destroyed in in many ways i mean i would

5592

03:29:06,469 --> 03:29:04,720

say the simplest way

5593

03:29:08,630 --> 03:29:06,479

which i remember very well away from

5594

03:29:11,510 --> 03:29:08,640

very beginning is just you know having

5595

03:29:13,110 --> 03:29:11,520

the sense of watching the looking at the

5596

03:29:14,469 --> 03:29:13,120

at the watch

5597

03:29:16,630 --> 03:29:14,479

and then you know

5598

03:29:19,190 --> 03:29:16,640

hours and hours later watching it again

5599

03:29:20,950 --> 03:29:19,200

and uh realizing that one minute had

5600

03:29:22,710 --> 03:29:20,960

passed so wait a minute all this

5601
03:29:23,990 --> 03:29:22,720
happened in one minute i mean my god

5602
03:29:25,110 --> 03:29:24,000
which is one of the things people get

5603
03:29:27,030 --> 03:29:25,120
scared

5604
03:29:28,790 --> 03:29:27,040
right so one one of the things i mean

5605
03:29:29,990 --> 03:29:28,800
the only the problem with lsd if you get

5606
03:29:31,349 --> 03:29:30,000
scared

5607
03:29:33,830 --> 03:29:31,359
and you

5608
03:29:35,269 --> 03:29:33,840
you get terrorized and it's extremely

5609
03:29:37,670 --> 03:29:35,279
psychologically dangerous yeah it can be

5610
03:29:38,790 --> 03:29:37,680
very bad it doesn't happen often but

5611
03:29:40,710 --> 03:29:38,800
it's uh

5612
03:29:42,309 --> 03:29:40,720
i think it's the only real problem in

5613
03:29:44,550 --> 03:29:42,319

these things the only real danger of

5614

03:29:46,710 --> 03:29:44,560

this is having a

5615

03:29:48,229 --> 03:29:46,720

couple a few very bad hours which may

5616

03:29:49,429 --> 03:29:48,239

look very wrong and then one of the

5617

03:29:51,750 --> 03:29:49,439

reasons you get scared is when you

5618

03:29:53,429 --> 03:29:51,760

realize that you know you feel the time

5619

03:29:55,590 --> 03:29:53,439

is passing but it's not passing outside

5620

03:29:57,110 --> 03:29:55,600

you you feel trapped

5621

03:29:59,110 --> 03:29:57,120

oh my god i'm here and then come out of

5622

03:30:01,429 --> 03:29:59,120

you okay it's because here for me time

5623

03:30:03,590 --> 03:30:01,439

is it's it's passing and outside is not

5624

03:30:05,590 --> 03:30:03,600

passing so that's one of the security

5625

03:30:07,429 --> 03:30:05,600

but that's

5626

03:30:09,110 --> 03:30:07,439

extraordinary strong distortion of the

5627

03:30:11,750 --> 03:30:09,120

sense of how much time is fast it's just

5628

03:30:13,910 --> 03:30:11,760

one aspect of it because uh

5629

03:30:17,110 --> 03:30:13,920

i think the sense that people talk about

5630

03:30:19,510 --> 03:30:17,120

that it's a sense of completely destroy

5631

03:30:20,870 --> 03:30:19,520

what it means by temporal organization

5632

03:30:23,510 --> 03:30:20,880

of the world

5633

03:30:25,030 --> 03:30:23,520

and the other common thing is this

5634

03:30:27,910 --> 03:30:25,040

distinction between yourself and the

5635

03:30:30,070 --> 03:30:27,920

outside right it's a basic

5636

03:30:32,309 --> 03:30:30,080

it's a basic

5637

03:30:34,630 --> 03:30:32,319

category in our think about valid so

5638

03:30:36,309 --> 03:30:34,640

there's me in the rest me it's me and

5639

03:30:39,110 --> 03:30:36,319

the rest is rest

5640

03:30:41,429 --> 03:30:39,120

and this is something which uh

5641

03:30:43,030 --> 03:30:41,439

it was very clear in my experiences is

5642

03:30:45,830 --> 03:30:43,040

common in many reports of this

5643

03:30:48,309 --> 03:30:45,840

experience is that you use

5644

03:30:50,309 --> 03:30:48,319

the sense of you as a self separate

5645

03:30:52,070 --> 03:30:50,319

distinct from um

5646

03:30:54,469 --> 03:30:52,080

from the rest it's very strong it's very

5647

03:30:57,349 --> 03:30:54,479

physical the lsd experience is a very

5648

03:31:00,309 --> 03:30:57,359

uh it's it's a very

5649

03:31:03,110 --> 03:31:00,319

powerful thing in fact i remember

5650

03:31:05,670 --> 03:31:03,120

spending days and days after that

5651
03:31:07,349 --> 03:31:05,680
sort of under the shock it was not bad

5652
03:31:09,190 --> 03:31:07,359
but it was also

5653
03:31:10,870 --> 03:31:09,200
disturbing tiring

5654
03:31:12,550 --> 03:31:10,880
i mean my mind had kept going back to

5655
03:31:14,389 --> 03:31:12,560
that for what has happened that means oh

5656
03:31:16,150 --> 03:31:14,399
my god what what has happened where am i

5657
03:31:17,590 --> 03:31:16,160
who am i what is

5658
03:31:19,269 --> 03:31:17,600
um

5659
03:31:22,229 --> 03:31:19,279
not unpleasant for me it was never been

5660
03:31:24,710 --> 03:31:22,239
unpleasant it has always been pleasant

5661
03:31:29,750 --> 03:31:24,720
uh very pleasant extremely pleasant i

5662
03:31:32,070 --> 03:31:29,760
had a i i faced it without preparation

5663
03:31:34,070 --> 03:31:32,080

but my friend was with me who had no

5664

03:31:36,070 --> 03:31:34,080

preparation and no

5665

03:31:37,990 --> 03:31:36,080

experience either

5666

03:31:42,229 --> 03:31:38,000

actually said the right thing at the

5667

03:31:45,670 --> 03:31:43,830

the right thing being don't be scared

5668

03:31:48,870 --> 03:31:45,680

whatever happens don't worry just let it

5669

03:31:50,710 --> 03:31:48,880

go and uh just don't resist

5670

03:31:51,670 --> 03:31:50,720

and just be aware that then you come

5671

03:31:55,190 --> 03:31:51,680

back and

5672

03:31:56,469 --> 03:31:55,200

whatever happens you back yourself so

5673

03:31:58,229 --> 03:31:56,479

um

5674

03:31:59,510 --> 03:31:58,239

that's very assured because he said

5675

03:32:01,590 --> 03:31:59,520

exactly right i think the moment in

5676
03:32:04,630 --> 03:32:01,600
which i got scared i remembered that and

5677
03:32:07,349 --> 03:32:04,640
said okay i'll trust him let things go

5678
03:32:08,710 --> 03:32:07,359
and let this strange experience go over

5679
03:32:12,309 --> 03:32:08,720
you

5680
03:32:18,070 --> 03:32:14,710
i loved it it stayed with me and somehow

5681
03:32:21,510 --> 03:32:18,080
in the moment in which i am in deep

5682
03:32:23,590 --> 03:32:21,520
which we all go through in our life

5683
03:32:26,550 --> 03:32:23,600
i remember that moment there is it's

5684
03:32:28,229 --> 03:32:26,560
it's calming to me it says good luck i

5685
03:32:29,910 --> 03:32:28,239
look at my hands the way i looked at my

5686
03:32:31,670 --> 03:32:29,920
hands in that and i

5687
03:32:34,150 --> 03:32:31,680
i have a sense of

5688
03:32:36,070 --> 03:32:34,160

separation from reality and

5689

03:32:37,910 --> 03:32:36,080

and the beauty of reality they start the

5690

03:32:39,190 --> 03:32:37,920

beauty of reality in front of me just

5691

03:32:40,150 --> 03:32:39,200

how it is

5692

03:32:42,389 --> 03:32:40,160

um

5693

03:32:43,990 --> 03:32:42,399

which i

5694

03:32:46,790 --> 03:32:44,000

remember as a gift of that particular

5695

03:32:49,349 --> 03:32:46,800

moment that stays with me all my life

5696

03:32:53,590 --> 03:32:49,359

was it a moment of utter peace or

5697

03:32:57,190 --> 03:32:55,190

like what was what would be the word

5698

03:32:58,790 --> 03:32:57,200

that you would characterize it

5699

03:33:00,229 --> 03:32:58,800

these people would say positive but

5700

03:33:04,550 --> 03:33:00,239

there's so many different senses of the

5701
03:33:08,229 --> 03:33:06,309
no we're not called peace we're not

5702
03:33:11,190 --> 03:33:08,239
called serene

5703
03:33:12,710 --> 03:33:11,200
i was not called euphoria

5704
03:33:15,590 --> 03:33:12,720
either

5705
03:33:18,070 --> 03:33:15,600
um i don't know emotionally

5706
03:33:21,269 --> 03:33:18,080
it was uh

5707
03:33:23,910 --> 03:33:21,279
completely overwhelming

5708
03:33:25,910 --> 03:33:23,920
surprise

5709
03:33:27,510 --> 03:33:25,920
and a sense of

5710
03:33:29,590 --> 03:33:27,520
violent

5711
03:33:32,469 --> 03:33:29,600
almost joy at some moment

5712
03:33:34,150 --> 03:33:32,479
oh wow i feel overwhelmed by the beauty

5713
03:33:36,550 --> 03:33:34,160

of things

5714

03:33:37,910 --> 03:33:36,560

and like seeing things for the first

5715

03:33:39,830 --> 03:33:37,920

time it's a

5716

03:33:41,830 --> 03:33:39,840

strange thing like like if i was oh my

5717

03:33:45,510 --> 03:33:41,840

god i've never seen that but this is

5718

03:33:46,550 --> 03:33:45,520

just you know my hand or a tree believe

5719

03:33:47,429 --> 03:33:46,560

anything

5720

03:33:49,349 --> 03:33:47,439

um

5721

03:33:51,030 --> 03:33:49,359

and by overwhelmed by the beauty of it

5722

03:33:53,429 --> 03:33:51,040

and be aware that you know this is just

5723

03:33:55,190 --> 03:33:53,439

a leaf and that's i could look at it as

5724

03:33:57,030 --> 03:33:55,200

an incredibly beautiful thing it's just

5725

03:33:58,950 --> 03:33:57,040

me and that's my heart opening up and

5726

03:34:01,429 --> 03:33:58,960

just exploding but

5727

03:34:04,070 --> 03:34:01,439

it's notoriously hard to describe those

5728

03:34:06,550 --> 03:34:04,080

experiences everybody says so and now

5729

03:34:08,630 --> 03:34:06,560

there is a growing literature

5730

03:34:11,110 --> 03:34:08,640

because finally

5731

03:34:13,590 --> 03:34:11,120

scientists can study these substances

5732

03:34:16,229 --> 03:34:13,600

after it was forbidden to study this

5733

03:34:17,990 --> 03:34:16,239

science substances for 40 years it's

5734

03:34:20,950 --> 03:34:18,000

completely stupid because why should you

5735

03:34:22,150 --> 03:34:20,960

know people study poisons or you know

5736

03:34:25,030 --> 03:34:22,160

heroin

5737

03:34:27,110 --> 03:34:25,040

why shouldn't you study this sciences

5738

03:34:30,550 --> 03:34:27,120

um

5739

03:34:33,110 --> 03:34:30,560

so i hope that now the very body

5740

03:34:34,550 --> 03:34:33,120

take away this silly

5741

03:34:36,070 --> 03:34:34,560

yes yeah yeah

5742

03:34:38,229 --> 03:34:36,080

for beating

5743

03:34:39,830 --> 03:34:38,239

studying these things

5744

03:34:41,030 --> 03:34:39,840

so it didn't directly help you with

5745

03:34:42,710 --> 03:34:41,040

physics but it helped you with

5746

03:34:45,269 --> 03:34:42,720

entertaining ideas that other people

5747

03:34:47,110 --> 03:34:45,279

would consider unpalatable such as time

5748

03:34:48,870 --> 03:34:47,120

doesn't exist or so-and-so is relational

5749

03:34:49,990 --> 03:34:48,880

rather than real

5750

03:34:53,429 --> 03:34:50,000

exactly

5751
03:34:55,429 --> 03:34:53,439
lee smalling you need to give lee

5752
03:34:57,910 --> 03:34:55,439
smalling some lsd to dissuade him of his

5753
03:34:58,790 --> 03:34:57,920
ideas of the primacy

5754
03:35:01,110 --> 03:34:58,800
and that's what i'm going to read

5755
03:35:03,269 --> 03:35:01,120
between the lines okay

5756
03:35:05,110 --> 03:35:03,279
last two questions last two

5757
03:35:08,710 --> 03:35:05,120
go to do you know who

5758
03:35:10,630 --> 03:35:08,720
whitehead is alfred north whitehead

5759
03:35:13,269 --> 03:35:10,640
yeah okay so this question comes from

5760
03:35:15,510 --> 03:35:13,279
aaron haidari says ravelli seems to

5761
03:35:17,349 --> 03:35:15,520
reflect

5762
03:35:18,790 --> 03:35:17,359
a lot of the pen

5763
03:35:20,550 --> 03:35:18,800

theist

5764

03:35:23,110 --> 03:35:20,560

process philosophy that whitehead talks

5765

03:35:24,950 --> 03:35:23,120

about i wonder if he's familiar with

5766

03:35:27,110 --> 03:35:24,960

whitehead and what he

5767

03:35:28,150 --> 03:35:27,120

thinks of this more organic view of

5768

03:35:29,030 --> 03:35:28,160

reality

5769

03:35:30,630 --> 03:35:29,040

yeah

5770

03:35:32,550 --> 03:35:30,640

well um

5771

03:35:35,349 --> 03:35:32,560

i i got to know what had precisely

5772

03:35:38,229 --> 03:35:35,359

because other people already

5773

03:35:39,510 --> 03:35:38,239

pointed out similarities

5774

03:35:40,790 --> 03:35:39,520

especially

5775

03:35:43,429 --> 03:35:40,800

thinking

5776

03:35:45,590 --> 03:35:43,439

reality as a process

5777

03:35:46,790 --> 03:35:45,600

if not that entities

5778

03:35:48,630 --> 03:35:46,800

um

5779

03:35:50,550 --> 03:35:48,640

hint it is with property but

5780

03:35:52,630 --> 03:35:50,560

happening of things so

5781

03:35:54,870 --> 03:35:52,640

processes before things

5782

03:35:56,710 --> 03:35:54,880

um

5783

03:35:59,030 --> 03:35:56,720

definitely there is this resonance and

5784

03:36:00,710 --> 03:35:59,040

the similarity and i'm sure that's

5785

03:36:02,950 --> 03:36:00,720

you know my way of thinking might have

5786

03:36:04,630 --> 03:36:02,960

been affected by by him or by people who

5787

03:36:05,670 --> 03:36:04,640

were affected by him

5788

03:36:09,429 --> 03:36:05,680

um

5789

03:36:12,070 --> 03:36:09,439

so i read i i started reading

5790

03:36:14,150 --> 03:36:12,080

uh some of his books because of that

5791

03:36:15,590 --> 03:36:14,160

because people pointed out this

5792

03:36:17,750 --> 03:36:15,600

analogies

5793

03:36:19,750 --> 03:36:17,760

and i i saw the analogy so i saw the

5794

03:36:23,269 --> 03:36:19,760

similarities i try to get something

5795

03:36:24,550 --> 03:36:23,279

useful from it but there is a size

5796

03:36:26,150 --> 03:36:24,560

there is a

5797

03:36:27,269 --> 03:36:26,160

an aspect of it

5798

03:36:28,870 --> 03:36:27,279

which i don't

5799

03:36:31,190 --> 03:36:28,880

connect to

5800

03:36:37,030 --> 03:36:34,229

which is this more organic or even

5801
03:36:39,429 --> 03:36:37,040
spiritualist

5802
03:36:42,150 --> 03:36:39,439
right there's a somehow

5803
03:36:43,110 --> 03:36:42,160
the way he faces the problems i i

5804
03:36:45,349 --> 03:36:43,120
couldn't

5805
03:36:48,870 --> 03:36:45,359
in spite of definite uh

5806
03:36:50,469 --> 03:36:48,880
similarities in this main idea that we

5807
03:36:53,990 --> 03:36:50,479
we describe the world as a process but

5808
03:36:58,389 --> 03:36:56,630
but but i'm a deeply a physicist

5809
03:37:01,030 --> 03:36:58,399
um

5810
03:37:03,429 --> 03:37:01,040
a physicalist

5811
03:37:04,630 --> 03:37:03,439
but i think that the the the physical

5812
03:37:07,990 --> 03:37:04,640
description of the world that we have

5813
03:37:11,110 --> 03:37:08,000

now it's it's it's very good as it is um

5814

03:37:15,590 --> 03:37:12,710

uh

5815

03:37:16,950 --> 03:37:15,600

to be reinforced by

5816

03:37:18,950 --> 03:37:16,960

by other pieces it has to be better

5817

03:37:21,190 --> 03:37:18,960

understood perhaps

5818

03:37:23,110 --> 03:37:21,200

and and i try to read what we know about

5819

03:37:25,349 --> 03:37:23,120

the world at that level

5820

03:37:27,110 --> 03:37:25,359

um from the physics itself and i think

5821

03:37:29,030 --> 03:37:27,120

it's not contradictory with a higher

5822

03:37:31,030 --> 03:37:29,040

level description of the world

5823

03:37:33,510 --> 03:37:31,040

okay with the ones given by biology by

5824

03:37:34,790 --> 03:37:33,520

sociology by psychology by you know

5825

03:37:36,550 --> 03:37:34,800

everything i think there's a there's

5826

03:37:38,150 --> 03:37:36,560

coherence we don't understand many of

5827

03:37:40,710 --> 03:37:38,160

the intermediate steps

5828

03:37:43,590 --> 03:37:40,720

uh but there's clearance between these

5829

03:37:45,269 --> 03:37:43,600

different pictures of of of the world

5830

03:37:47,590 --> 03:37:45,279

well of course we need a higher level

5831

03:37:49,190 --> 03:37:47,600

ones because uh

5832

03:37:50,469 --> 03:37:49,200

because we cannot i cannot describe my

5833

03:37:52,710 --> 03:37:50,479

girlfriends who are using maxwell

5834

03:37:54,710 --> 03:37:52,720

equations that doesn't work

5835

03:37:57,110 --> 03:37:54,720

there's no contradiction between she

5836

03:37:59,190 --> 03:37:57,120

being made by atoms uh

5837

03:38:01,110 --> 03:37:59,200

governed by the maxwell equations

5838

03:38:03,110 --> 03:38:01,120

and you know she being somebody i love

5839

03:38:04,469 --> 03:38:03,120

and she loves me and we interact on the

5840

03:38:05,670 --> 03:38:04,479

level of our

5841

03:38:07,269 --> 03:38:05,680

emotions

5842

03:38:09,110 --> 03:38:07,279

uh they're just different different

5843

03:38:11,429 --> 03:38:09,120

levels of description some which works

5844

03:38:13,110 --> 03:38:11,439

better as some aggregate of things and

5845

03:38:14,229 --> 03:38:13,120

some which works better

5846

03:38:15,590 --> 03:38:14,239

um

5847

03:38:17,590 --> 03:38:15,600

and and

5848

03:38:20,070 --> 03:38:17,600

i don't see any a priori contradiction

5849

03:38:21,990 --> 03:38:20,080

between that and there's no need

5850

03:38:24,070 --> 03:38:22,000

to um

5851
03:38:27,349 --> 03:38:24,080
to add higher level notions to the

5852
03:38:29,030 --> 03:38:27,359
fundamental notions

5853
03:38:30,710 --> 03:38:29,040
when it comes to the problem of quantum

5854
03:38:32,630 --> 03:38:30,720
gravity or theories of everything or

5855
03:38:36,389 --> 03:38:32,640
grand unified theories do you think that

5856
03:38:38,469 --> 03:38:36,399
what's missing is a whole conceptual

5857
03:38:40,070 --> 03:38:38,479
paradigm shift or is it just it's a

5858
03:38:41,830 --> 03:38:40,080
mathematical complication it can be

5859
03:38:43,830 --> 03:38:41,840
solved

5860
03:38:45,429 --> 03:38:43,840
without changing our view of what

5861
03:38:46,550 --> 03:38:45,439
reality is much

5862
03:38:48,710 --> 03:38:46,560
like what do you think is holding us

5863
03:38:49,990 --> 03:38:48,720

back which one is it

5864

03:38:51,750 --> 03:38:50,000

i think it's there's nothing holding

5865

03:38:55,110 --> 03:38:51,760

back i think we have theories of quantum

5866

03:38:57,510 --> 03:38:55,120

gravity and that might be right um

5867

03:38:59,590 --> 03:38:57,520

so we don't need to go look for new

5868

03:39:01,750 --> 03:38:59,600

ideas in quantum gravity we have to we

5869

03:39:03,750 --> 03:39:01,760

go we have to go try to figure out if

5870

03:39:05,910 --> 03:39:03,760

the ideas we have a good or bad

5871

03:39:07,750 --> 03:39:05,920

um i think this idea that all quantum

5872

03:39:09,910 --> 03:39:07,760

gravity is such a mystery that we need

5873

03:39:12,790 --> 03:39:09,920

some new idea why do we need some new

5874

03:39:14,389 --> 03:39:12,800

idea i mean we have theories the reason

5875

03:39:15,910 --> 03:39:14,399

we're not sure is that we cannot test

5876

03:39:16,950 --> 03:39:15,920

them not because they're wrong or

5877

03:39:18,630 --> 03:39:16,960

they're bad

5878

03:39:20,070 --> 03:39:18,640

group point to gravity is one i don't

5879

03:39:21,349 --> 03:39:20,080

want to say this is the right theory

5880

03:39:22,950 --> 03:39:21,359

because it might be wrong theory might

5881

03:39:24,710 --> 03:39:22,960

another one may be right

5882

03:39:26,389 --> 03:39:24,720

or maybe we haven't yet you know

5883

03:39:28,550 --> 03:39:26,399

understood the relation between this or

5884

03:39:30,389 --> 03:39:28,560

maybe i mean i have the reasons to think

5885

03:39:33,030 --> 03:39:30,399

that string theory is not good it looks

5886

03:39:35,670 --> 03:39:33,040

going to gravity is good but

5887

03:39:38,710 --> 03:39:35,680

for quantum gravity itself we have

5888

03:39:40,550 --> 03:39:38,720

decent theories of the the missing staff

5889

03:39:41,510 --> 03:39:40,560

the piece pieces we don't understand

5890

03:39:43,830 --> 03:39:41,520

well

5891

03:39:46,150 --> 03:39:43,840

but i don't

5892

03:39:49,030 --> 03:39:46,160

share this idea oh my god we're missing

5893

03:39:51,510 --> 03:39:49,040

a big idea we're not missing a big idea

5894

03:39:53,030 --> 03:39:51,520

to articulate something like loop

5895

03:39:55,030 --> 03:39:53,040

quantum gravity you need a big

5896

03:39:57,349 --> 03:39:55,040

conceptual shift because there's no

5897

03:39:59,429 --> 03:39:57,359

background space no background time as i

5898

03:40:00,950 --> 03:39:59,439

said before you have to accept the idea

5899

03:40:03,110 --> 03:40:00,960

that the fundamental shift of the world

5900

03:40:05,830 --> 03:40:03,120

you don't use the time variable so it's

5901
03:40:08,790 --> 03:40:05,840
already there it has been worked out is

5902
03:40:10,389 --> 03:40:08,800
is decades of discussions

5903
03:40:12,710 --> 03:40:10,399
that have come out with a

5904
03:40:14,389 --> 03:40:12,720
a possible story

5905
03:40:16,229 --> 03:40:14,399
we have more than one possible stories

5906
03:40:18,389 --> 03:40:16,239
because there are other alter possible

5907
03:40:20,790 --> 03:40:18,399
alternatives is you know symptomatic

5908
03:40:21,990 --> 03:40:20,800
safety the string theory and

5909
03:40:23,910 --> 03:40:22,000
and others

5910
03:40:26,150 --> 03:40:23,920
uh but we have things about quantum

5911
03:40:28,550 --> 03:40:26,160
gravity what we miss

5912
03:40:30,150 --> 03:40:28,560
is you know filling up details

5913
03:40:31,750 --> 03:40:30,160

you know look what it's hard to do

5914

03:40:33,349 --> 03:40:31,760

calculation of scattering string

5915

03:40:35,269 --> 03:40:33,359

theories how to understand how to come

5916

03:40:36,710 --> 03:40:35,279

down four dimensions nobody really has

5917

03:40:38,950 --> 03:40:36,720

done it yet

5918

03:40:40,790 --> 03:40:38,960

uh the the you know the schemes ideas

5919

03:40:42,950 --> 03:40:40,800

but the body goes from the big theory

5920

03:40:44,389 --> 03:40:42,960

down to the to the standard model

5921

03:40:46,790 --> 03:40:44,399

um

5922

03:40:48,710 --> 03:40:46,800

i i would not look for other

5923

03:40:50,150 --> 03:40:48,720

why should we look for other ideas that

5924

03:40:54,070 --> 03:40:50,160

then we just you know put them in a

5925

03:40:57,510 --> 03:40:54,950

we need

5926
03:40:59,510 --> 03:40:57,520
smart ideas for checking those theories

5927
03:41:01,830 --> 03:40:59,520
and and that's what many people doing

5928
03:41:03,030 --> 03:41:01,840
working on black holes working on early

5929
03:41:05,030 --> 03:41:03,040
universe

5930
03:41:08,790 --> 03:41:05,040
trying to see if some of the theories we

5931
03:41:12,710 --> 03:41:10,229
just so you know that question was from

5932
03:41:14,389 --> 03:41:12,720
dong hyun yoon i just wanted to make

5933
03:41:16,950 --> 03:41:14,399
sure to say that and the last last

5934
03:41:18,870 --> 03:41:16,960
question is craig reed tcr i'd be

5935
03:41:21,670 --> 03:41:18,880
curious to know what he thinks of nema

5936
03:41:23,030 --> 03:41:21,680
arkani ahmed's amplitude and his lecture

5937
03:41:27,590 --> 03:41:23,040
on the end of space time i don't think

5938
03:41:32,389 --> 03:41:31,110

lima is great um it's a uh it's a

5939

03:41:34,630 --> 03:41:32,399

powerful thinker it's a great

5940

03:41:36,229 --> 03:41:34,640

mathematician i had

5941

03:41:38,710 --> 03:41:36,239

i remember a very good

5942

03:41:40,070 --> 03:41:38,720

afternoon in princeton talking with him

5943

03:41:41,269 --> 03:41:40,080

um

5944

03:41:43,910 --> 03:41:41,279

i

5945

03:41:46,150 --> 03:41:43,920

there's a book that just came out

5946

03:41:48,870 --> 03:41:46,160

um which is a

5947

03:41:49,830 --> 03:41:48,880

big thick book with interviews of people

5948

03:41:51,910 --> 03:41:49,840

in uh

5949

03:41:55,189 --> 03:41:51,920

quantum gravity

5950

03:41:57,750 --> 03:41:56,469

uh

5951

03:41:59,349 --> 03:41:57,760

i can just look it up if you give me a

5952

03:42:01,670 --> 03:41:59,359

keyword so i can tell the audience what

5953

03:42:03,950 --> 03:42:01,680

it is it is sitting here let me go get

5954

03:42:06,469 --> 03:42:03,960

it yeah great

5955

03:42:08,309 --> 03:42:06,479

conversations on quantum gravity

5956

03:42:13,349 --> 03:42:08,319

wonderful

5957

03:42:16,790 --> 03:42:13,359

edited by jacom armas a-r-m-a-s

5958

03:42:18,550 --> 03:42:16,800

and uh it's it's a big thick book um

5959

03:42:21,269 --> 03:42:18,560

of interviews

5960

03:42:25,189 --> 03:42:21,279

detailed interviews of uh

5961

03:42:27,110 --> 03:42:25,199

a large uh number of people um

5962

03:42:28,870 --> 03:42:27,120

doing quantum gravity it's a bit boring

5963

03:42:30,630 --> 03:42:28,880

because it's a big thing with everybody

5964

03:42:32,790 --> 03:42:30,640

you know same question so

5965

03:42:35,030 --> 03:42:32,800

to but i'm going systematically through

5966

03:42:36,469 --> 03:42:35,040

it and reading all of it

5967

03:42:37,830 --> 03:42:36,479

because i'm curious to actually know

5968

03:42:39,750 --> 03:42:37,840

what the various people and it's

5969

03:42:41,750 --> 03:42:39,760

remarkable they're very

5970

03:42:44,550 --> 03:42:41,760

diverse ideas

5971

03:42:48,229 --> 03:42:44,560

and i read uh the one of nina uh

5972

03:42:50,269 --> 03:42:48,239

academic uh in in detail of course um

5973

03:42:52,550 --> 03:42:50,279

because his alphabetical order

5974

03:42:55,510 --> 03:42:52,560

is the first

5975

03:42:56,870 --> 03:42:55,520

um i'm just almost halfway past halfway

5976

03:42:59,590 --> 03:42:56,880

through the book

5977

03:43:02,790 --> 03:42:59,600

and uh so i'm i'm thinking

5978

03:43:04,710 --> 03:43:02,800

while reading the various uh

5979

03:43:06,229 --> 03:43:04,720

people i'm curious to know what all the

5980

03:43:07,830 --> 03:43:06,239

people think i'm i'm reading and of

5981

03:43:09,910 --> 03:43:07,840

course i'm

5982

03:43:11,830 --> 03:43:09,920

i'm checking what they say with respect

5983

03:43:13,670 --> 03:43:11,840

to what i think and i'm trying to get

5984

03:43:15,670 --> 03:43:13,680

the ideas that i don't know and trying

5985

03:43:18,550 --> 03:43:15,680

to argue

5986

03:43:19,590 --> 03:43:18,560

so it's a very good exercise for me um

5987

03:43:24,630 --> 03:43:19,600

now

5988

03:43:28,790 --> 03:43:27,590

he belongs to um

5989

03:43:30,389 --> 03:43:28,800

that

5990

03:43:32,550 --> 03:43:30,399

uh

5991

03:43:36,389 --> 03:43:32,560

part of the community

5992

03:43:40,309 --> 03:43:36,399

who um has fell in love with the

5993

03:43:42,870 --> 03:43:40,319

maldecinna idea of the bulk boundary

5994

03:43:46,870 --> 03:43:42,880

and then later on has given

5995

03:43:49,269 --> 03:43:46,880

a sort of an ideological basis on that

5996

03:43:52,630 --> 03:43:49,279

by an argument

5997

03:43:55,349 --> 03:43:52,640

that says that in quantum gravity

5998

03:43:57,189 --> 03:43:55,359

we have to go to infinity

5999

03:43:58,870 --> 03:43:57,199

uh to

6000

03:44:01,349 --> 03:43:58,880

to define the theory

6001
03:44:03,670 --> 03:44:01,359
because there are physical reasons

6002
03:44:05,349 --> 03:44:03,680
for which we cannot make a measurement

6003
03:44:08,389 --> 03:44:05,359
in the bulk so to say

6004
03:44:10,389 --> 03:44:08,399
so all the actual measurements are uh

6005
03:44:12,710 --> 03:44:10,399
and uh in fact in the book he articulate

6006
03:44:14,710 --> 03:44:12,720
that because this is good because he

6007
03:44:17,189 --> 03:44:14,720
he explains his you know his deep

6008
03:44:18,950 --> 03:44:17,199
motivations for doing that

6009
03:44:21,030 --> 03:44:18,960
now i'm convinced that this argument is

6010
03:44:22,070 --> 03:44:21,040
wrong um

6011
03:44:25,269 --> 03:44:22,080
uh

6012
03:44:26,389 --> 03:44:25,279
because it presupposes the space-time

6013
03:44:28,710 --> 03:44:26,399

and uh

6014

03:44:30,630 --> 03:44:28,720

because uh it uh

6015

03:44:32,870 --> 03:44:30,640

it mixes

6016

03:44:35,510 --> 03:44:32,880

uh the need for the coherence for making

6017

03:44:37,910 --> 03:44:35,520

measurements with the distance in space

6018

03:44:41,510 --> 03:44:37,920

so they i think it's technically wrong

6019

03:44:44,790 --> 03:44:41,520

and but this is has become a dogma in in

6020

03:44:47,670 --> 03:44:44,800

his word especially in princeton um

6021

03:44:49,030 --> 03:44:47,680

that you can only describe things from

6022

03:44:51,429 --> 03:44:49,040

from a very large distance from a

6023

03:44:54,630 --> 03:44:51,439

syntactic distance

6024

03:44:56,790 --> 03:44:54,640

so he's going entirely in that direction

6025

03:44:58,790 --> 03:44:56,800

and that's why he doesn't

6026
03:45:00,790 --> 03:44:58,800
think that loop quantum gravity might

6027
03:45:01,910 --> 03:45:00,800
work because loop control it is a

6028
03:45:04,469 --> 03:45:01,920
description

6029
03:45:06,710 --> 03:45:04,479
of quantum space time locally in in a

6030
03:45:08,710 --> 03:45:06,720
small region so i'm i'm here

6031
03:45:10,870 --> 03:45:08,720
i i make an experiment a quantum

6032
03:45:12,469 --> 03:45:10,880
experiment and i compute what comes out

6033
03:45:13,750 --> 03:45:12,479
without need to go to

6034
03:45:16,070 --> 03:45:13,760
centopia

6035
03:45:19,830 --> 03:45:17,750
so uh

6036
03:45:22,870 --> 03:45:19,840
you know these people are going doing

6037
03:45:26,229 --> 03:45:22,880
technical work but that's the assumption

6038
03:45:27,110 --> 03:45:26,239

uh on which also his work on the on the

6039

03:45:29,830 --> 03:45:27,120

um

6040

03:45:31,830 --> 03:45:29,840

scattering amplitudes

6041

03:45:34,389 --> 03:45:31,840

it's good but it's not

6042

03:45:37,990 --> 03:45:34,399

it's not in the four-dimensional

6043

03:45:40,389 --> 03:45:38,000

generativistic world in which we live so

6044

03:45:42,309 --> 03:45:40,399

uh i i don't think that the solution of

6045

03:45:46,229 --> 03:45:42,319

quantum gravity and the property of

6046

03:45:47,590 --> 03:45:46,239

quantum gravity is in fancy mathematics

6047

03:45:49,910 --> 03:45:47,600

um

6048

03:45:51,830 --> 03:45:49,920

i think it's in just writing the things

6049

03:45:53,830 --> 03:45:51,840

properly i mean there's a look on the

6050

03:45:56,469 --> 03:45:53,840

guide it defines scattering amplitudes

6051
03:45:58,950 --> 03:45:56,479
they're very hard to compute

6052
03:46:00,229 --> 03:45:58,960
but they're there

6053
03:46:03,110 --> 03:46:00,239
and

6054
03:46:05,189 --> 03:46:03,120
does that without going to the boundary

6055
03:46:06,150 --> 03:46:05,199
inside space-time

6056
03:46:08,070 --> 03:46:06,160
and the

6057
03:46:10,150 --> 03:46:08,080
objection here has to look into gravity

6058
03:46:11,750 --> 03:46:10,160
i think they're they're wrong i wish we

6059
03:46:13,590 --> 03:46:11,760
could uh you know with all these people

6060
03:46:14,870 --> 03:46:13,600
i wish we could sit down

6061
03:46:16,389 --> 03:46:14,880
and uh

6062
03:46:17,910 --> 03:46:16,399
maybe i'm arrogant but i think i could

6063
03:46:19,429 --> 03:46:17,920

convince them the sum of the assumptions

6064

03:46:21,750 --> 03:46:19,439

that they are wrong

6065

03:46:23,830 --> 03:46:21,760

of course almond center i may have

6066

03:46:27,110 --> 03:46:23,840

are wrong and i wish they could tell me

6067

03:46:29,590 --> 03:46:28,389

carlo

6068

03:46:31,110 --> 03:46:29,600

professor

6069

03:46:33,110 --> 03:46:31,120

thank you so much

6070

03:46:35,269 --> 03:46:33,120

it's been quite a good

6071

03:46:37,189 --> 03:46:35,279

quite a journey for over four hours been

6072

03:46:38,870 --> 03:46:37,199

long quite a journey you pushed me to

6073

03:46:40,790 --> 03:46:38,880

say a lot of ideas

6074

03:46:42,790 --> 03:46:40,800

into a lot of the things i've been

6075

03:46:45,510 --> 03:46:42,800

thinking so i liked i liked very much i

6076

03:46:47,429 --> 03:46:45,520

loved this interview

6077

03:46:49,189 --> 03:46:47,439

the podcast is now finished if you'd

6078

03:46:52,309 --> 03:46:49,199

like to support conversations like this

6079

03:46:55,229 --> 03:46:52,319

then do consider going to patreon.com

6080

03:47:00,070 --> 03:46:58,309

j-a-i-m-u-n-g-a-l that is kurt jaimungle

6081

03:47:01,670 --> 03:47:00,080

it's support from the patrons and from

6082

03:47:03,269 --> 03:47:01,680

the sponsors that allow me to do this