

1
00:00:01,179 --> 00:00:10,888
[Music]

2
00:00:05,929 --> 00:00:16,378
okay my talk is about the physical basis

3
00:00:10,888 --> 00:00:18,419
for nonlocality and first of all we

4
00:00:16,379 --> 00:00:23,699
should make clear that nonlocality

5
00:00:18,420 --> 00:00:27,830
is non-local causality the background to

6
00:00:23,699 --> 00:00:30,420
this diagram here is a spacetime diagram

7
00:00:27,829 --> 00:00:34,229
showing the separation of Toole art

8
00:00:30,420 --> 00:00:35,939
light particles in space going in

9
00:00:34,229 --> 00:00:42,599
opposite directions from each other and

10
00:00:35,939 --> 00:00:45,089
moving forward in time local causality

11
00:00:42,600 --> 00:00:49,439
says that the cause of these two

12
00:00:45,090 --> 00:00:53,730
particles is at the common source which

13
00:00:49,439 --> 00:00:55,320
is right there at the center non-local

14
00:00:53,729 --> 00:01:00,589
causality says that the cause is

15
00:00:55,320 --> 00:01:05,010
elsewhere picture a baseball in flight

16
00:01:00,590 --> 00:01:07,409
to going to the op field is the

17
00:01:05,010 --> 00:01:15,810
trajectory of the baseball caused by the

18
00:01:07,409 --> 00:01:21,090
batter or by the glove that catches the

19
00:01:15,810 --> 00:01:21,659
fly ball food for thought here's what

20
00:01:21,090 --> 00:01:26,400
we'll do

21
00:01:21,659 --> 00:01:29,640
I'll give you a nutshell description of

22
00:01:26,400 --> 00:01:32,640
Bell's Theorem show you a conceptual

23
00:01:29,640 --> 00:01:39,710
entangled particles experiment involving

24
00:01:32,640 --> 00:01:43,049
two polarized photons which is based on

25
00:01:39,709 --> 00:01:47,099
original experiments done to test the

26
00:01:43,049 --> 00:01:50,820
Bell's Theorem concept by Friedman and

27
00:01:47,099 --> 00:01:55,438
Claus ER in Berkeley and famously by

28
00:01:50,819 --> 00:01:57,929
Alanis Bey in France will discuss the

29

00:01:55,438 --> 00:02:00,389
quantum probabilities for the

30
00:01:57,930 --> 00:02:02,790
measurement outcome and then we'll

31
00:02:00,390 --> 00:02:06,239
discuss the local causality constraints

32
00:02:02,790 --> 00:02:08,909
on those outcomes finally we'll talk

33
00:02:06,239 --> 00:02:11,609
about non-local causality and the

34
00:02:08,909 --> 00:02:13,098
implications for time reversal of cause

35
00:02:11,610 --> 00:02:18,450
and effect

36
00:02:13,098 --> 00:02:28,159
Bell's Theorem says that under certain

37
00:02:18,449 --> 00:02:28,159
conditions under certain conditions

38
00:02:34,800 --> 00:02:38,610
well I'll just read predictions of

39
00:02:36,750 --> 00:02:42,000
measurement outcomes for certain

40
00:02:38,610 --> 00:02:45,600
entangled states are inconsistent with

41
00:02:42,000 --> 00:02:48,900
local causality Bell's Theorem was

42
00:02:45,599 --> 00:02:52,620
published nearly fifty years ago in the

43
00:02:48,900 --> 00:02:55,379

journal physics and it was the first

44

00:02:52,620 --> 00:02:57,659

issue of the journal and the journal

45

00:02:55,379 --> 00:03:00,599

interestingly enough folded after that

46

00:02:57,659 --> 00:03:03,810

first issue and for the next decade

47

00:03:00,599 --> 00:03:07,289

Bell's issue Bell sphere theorem was

48

00:03:03,810 --> 00:03:10,310

rather underwhelming the mathematical

49

00:03:07,289 --> 00:03:14,340

inequality was experimentally tested and

50

00:03:10,310 --> 00:03:16,800

it has consistently been found that

51

00:03:14,340 --> 00:03:21,210

quantum mechanics rules and local

52

00:03:16,800 --> 00:03:25,439

causality often fails present

53

00:03:21,210 --> 00:03:27,990

demonstration of bells inequality due to

54

00:03:25,439 --> 00:03:33,090

henry staff i will follow his analysis

55

00:03:27,990 --> 00:03:35,129

it was published in July of 1977 so this

56

00:03:33,090 --> 00:03:38,849

is all pretty old stuff here's the

57

00:03:35,129 --> 00:03:42,569

experimental setup we have a vibrating

58
00:03:38,849 --> 00:03:44,699
atom in a hot vapor in the middle it

59
00:03:42,569 --> 00:03:47,069
emits two photons going in opposite

60
00:03:44,699 --> 00:03:51,629
directions they are both polarized in

61
00:03:47,069 --> 00:03:53,789
the same plane one up and one down the

62
00:03:51,629 --> 00:03:58,229
direction of polarization is a

63
00:03:53,789 --> 00:04:01,379
superposition of all directions until a

64
00:03:58,229 --> 00:04:05,119
measurement is made and then there is

65
00:04:01,379 --> 00:04:10,289
just one direction of polarization the

66
00:04:05,120 --> 00:04:12,539
polarizer angles the polarizer axes are

67
00:04:10,289 --> 00:04:15,389
at an angle of θ with each other and

68
00:04:12,539 --> 00:04:20,870
we will be referring to θ during the

69
00:04:15,389 --> 00:04:24,949
discussion of the analysis the photons

70
00:04:20,870 --> 00:04:28,530
incident on the polarisers are either

71
00:04:24,949 --> 00:04:31,769
transmitted or absorbed if they are

72
00:04:28,529 --> 00:04:35,009
transmitted a single polarization state

73
00:04:31,769 --> 00:04:39,899
comes out and is detected by the

74
00:04:35,009 --> 00:04:42,329
detector well I've got rocks in my head

75
00:04:39,899 --> 00:04:44,759
for sure that's the success what's going

76
00:04:42,329 --> 00:04:46,349
on this morning either that I don't

77
00:04:44,759 --> 00:04:48,779
understand Bell's Theorem but I believe

78
00:04:46,350 --> 00:04:53,460
I do understand Bell's Theorem

79
00:04:48,779 --> 00:04:56,579
and I am not bothered by the time

80
00:04:53,459 --> 00:05:00,389
reversal of cause and effect which is

81
00:04:56,579 --> 00:05:03,240
where Bell's Theorem leads me that first

82
00:05:00,389 --> 00:05:07,199
statement I got out of physics today

83
00:05:03,240 --> 00:05:09,949
magazine a number of years ago the

84
00:05:07,199 --> 00:05:13,319
second statement is more famously

85
00:05:09,949 --> 00:05:15,000
attributed to Albert Einstein is the

86

00:05:13,319 --> 00:05:18,990
moon only there when I'm looking at it

87
00:05:15,000 --> 00:05:23,870
was his rebellion against the idea that

88
00:05:18,990 --> 00:05:27,060
the active formation of a state can be

89
00:05:23,870 --> 00:05:33,750
affected by a passive a passive

90
00:05:27,060 --> 00:05:36,750
observation of that state these symbols

91
00:05:33,750 --> 00:05:39,360
are the symbols that we were you will

92
00:05:36,750 --> 00:05:43,230
use to demonstrate the four outcomes

93
00:05:39,360 --> 00:05:46,080
four possible outcomes of photon

94
00:05:43,230 --> 00:05:48,629
incidents on the polarisers the two

95
00:05:46,079 --> 00:05:54,300
circles represent the front and rear

96
00:05:48,629 --> 00:05:56,370
polarisers the the blank or white open

97
00:05:54,300 --> 00:06:00,270
circle represents the transmission of a

98
00:05:56,370 --> 00:06:05,790
photon the shaded circle represents the

99
00:06:00,269 --> 00:06:08,549
absorption of a photon the upper-left

100
00:06:05,790 --> 00:06:11,970

corner is a coincidence measurement in

101

00:06:08,550 --> 00:06:16,170

which both photons are transmitted the

102

00:06:11,970 --> 00:06:18,990

lower right corner is a null measurement

103

00:06:16,170 --> 00:06:24,180

where both photons are absorbed the

104

00:06:18,990 --> 00:06:27,120

other two are mixed measurements these

105

00:06:24,180 --> 00:06:32,209

are the symbols that we will use to show

106

00:06:27,120 --> 00:06:35,009

the orientation of the polarizer x' the

107

00:06:32,209 --> 00:06:38,849

arrows will show schematically what the

108

00:06:35,009 --> 00:06:43,430

orientations are the angle θ is

109

00:06:38,850 --> 00:06:47,370

shown off to the left numerically if the

110

00:06:43,430 --> 00:06:48,870

circles are shaded green the results are

111

00:06:47,370 --> 00:06:52,230

due to quantum mechanics

112

00:06:48,870 --> 00:06:55,680

if the circles circles are shaded pink

113

00:06:52,230 --> 00:06:59,759

look almost purple here it's due to

114

00:06:55,680 --> 00:07:01,650

local causality here are the results for

115
00:06:59,759 --> 00:07:05,250
quantum mechanical measurement

116
00:07:01,649 --> 00:07:09,478
abilities the four large boxes are

117
00:07:05,250 --> 00:07:13,668
associated with the four polarizer angle

118
00:07:09,478 --> 00:07:17,250
settings these are chosen to display an

119
00:07:13,668 --> 00:07:22,109
inconsistency between quantum mechanics

120
00:07:17,250 --> 00:07:25,168
and local causality the four small boxes

121
00:07:22,110 --> 00:07:27,538
represent the four outcomes of a two

122
00:07:25,168 --> 00:07:34,099
photon incidence measurement that we

123
00:07:27,538 --> 00:07:41,038
discussed before by way of an example

124
00:07:34,100 --> 00:07:44,370
the upper right the two 50% are obtained

125
00:07:41,038 --> 00:07:48,209
when you have the polarisers aligned and

126
00:07:44,370 --> 00:07:50,550
you expect the photons which are both

127
00:07:48,209 --> 00:07:54,689
polarized in the same state to either be

128
00:07:50,550 --> 00:07:59,160
both transmitted or both rejected both

129
00:07:54,689 --> 00:08:03,418
absorb with equal probability well

130
00:07:59,160 --> 00:08:06,599
here's how we demonstrate the effects of

131
00:08:03,418 --> 00:08:09,810
local causality I won't go through this

132
00:08:06,598 --> 00:08:12,689
in great detail but what we do is we

133
00:08:09,810 --> 00:08:16,439
change the polarizer angles one at a

134
00:08:12,689 --> 00:08:20,310
time and as we change the polarizer

135
00:08:16,439 --> 00:08:24,329
angles we look at the effects the

136
00:08:20,310 --> 00:08:27,449
changes in the events from coincidence

137
00:08:24,329 --> 00:08:30,300
measurements to mixed measurements down

138
00:08:27,449 --> 00:08:32,519
to null measurements we fall we do this

139
00:08:30,300 --> 00:08:42,930
in two ways we follow the red arrows and

140
00:08:32,519 --> 00:08:45,929
the blue arrows now when we when we

141
00:08:42,929 --> 00:08:49,889
change a polarizer angle we assume that

142
00:08:45,929 --> 00:08:52,789
the very same exact set of photons is

143

00:08:49,889 --> 00:08:57,088
still incident on the two polarizers

144
00:08:52,789 --> 00:09:00,750
so the photons due to local causality

145
00:08:57,089 --> 00:09:03,660
the photons are like real objects when

146
00:09:00,750 --> 00:09:05,929
they strike the untrained polarizer they

147
00:09:03,659 --> 00:09:08,610
will transmit exactly as they did before

148
00:09:05,929 --> 00:09:10,949
when they strike the polarizer that has

149
00:09:08,610 --> 00:09:13,079
been changed they will be partially

150
00:09:10,950 --> 00:09:14,810
blocked because of the misalignment of

151
00:09:13,078 --> 00:09:18,528
the polarizer

152
00:09:14,809 --> 00:09:21,649
we follow the red arrows around the

153
00:09:18,528 --> 00:09:26,299
logic will tell us that if we assume

154
00:09:21,649 --> 00:09:28,519
that quantum mechanics is obeyed and the

155
00:09:26,299 --> 00:09:32,569
result is compatible with quantum

156
00:09:28,519 --> 00:09:38,000
mechanics that the fraction of events

157
00:09:32,570 --> 00:09:40,610

changed from coincidence in the upper

158

00:09:38,000 --> 00:09:44,120

left to no events in the lower right

159

00:09:40,610 --> 00:09:47,330

that fraction must be less than 25% if

160

00:09:44,120 --> 00:09:51,339

we follow the blue arrows around the

161

00:09:47,330 --> 00:09:54,650

logic tells us that that fraction F is

162

00:09:51,339 --> 00:09:57,050

constrained by the difference in n_1 and

163

00:09:54,649 --> 00:10:02,449

n_2 which are the two new probabilities

164

00:09:57,049 --> 00:10:06,069

due to local causality here are the

165

00:10:02,450 --> 00:10:08,390

results for quantum mechanics on the top

166

00:10:06,070 --> 00:10:12,470

showing the bottom two polarizer

167

00:10:08,389 --> 00:10:15,740

settings for quantum mechanics and for

168

00:10:12,470 --> 00:10:18,620

local causality the local causality

169

00:10:15,740 --> 00:10:21,259

numbers less than 38 percent and so

170

00:10:18,620 --> 00:10:23,029

forth are derived out to break Li from

171

00:10:21,259 --> 00:10:24,679

the constraints the inequality

172
00:10:23,029 --> 00:10:29,990
constraint that I showed you on the last

173
00:10:24,679 --> 00:10:34,929
side slide and you can see that the the

174
00:10:29,990 --> 00:10:39,169
quantum mechanical numbers such as 42%

175
00:10:34,929 --> 00:10:42,829
42.7% for the coincidence measurements

176
00:10:39,169 --> 00:10:47,659
do not fit within the upper boundary for

177
00:10:42,830 --> 00:10:50,589
the for the local causality constraints

178
00:10:47,659 --> 00:10:54,100
so this shows that you that for a

179
00:10:50,589 --> 00:10:57,100
particular set of polarizer settings

180
00:10:54,100 --> 00:11:00,800
quantum mechanics is incompatible with

181
00:10:57,100 --> 00:11:06,080
local causality so what does this mean

182
00:11:00,799 --> 00:11:08,719
as far as causality is concerned if the

183
00:11:06,080 --> 00:11:12,170
cause is not at the source where is it

184
00:11:08,720 --> 00:11:15,800
is it with the observation is it at

185
00:11:12,169 --> 00:11:19,610
the detector one hypothesis the common

186
00:11:15,799 --> 00:11:23,329
explanation for this is that the two two

187
00:11:19,610 --> 00:11:25,490
for two photons are form a single

188
00:11:23,330 --> 00:11:29,440
quantum system a superposition of states

189
00:11:25,490 --> 00:11:29,440
when a measurement is May

190
00:11:30,179 --> 00:11:36,699
the system immediately falls into a

191
00:11:33,850 --> 00:11:39,850
sting single state and that appears at

192
00:11:36,700 --> 00:11:42,839
both detector 1 and detector 2 instantly

193
00:11:39,850 --> 00:11:46,089
this doesn't explain to us very well

194
00:11:42,839 --> 00:11:52,240
what really happens in terms of space

195
00:11:46,089 --> 00:11:54,370
and time one explanation is that the

196
00:11:52,240 --> 00:11:56,379
source and the two detectors could be

197
00:11:54,370 --> 00:12:01,500
connected in some way in an interaction

198
00:11:56,379 --> 00:12:06,879
and that that detection could cause the

199
00:12:01,500 --> 00:12:09,879
that yeah that detection could cause the

200

00:12:06,879 --> 00:12:16,450
photons to be transmitted in the proper

201
00:12:09,879 --> 00:12:18,689
form too to obey quantum mechanics this

202
00:12:16,450 --> 00:12:21,490
would result in a superluminal

203
00:12:18,690 --> 00:12:23,410
transmission of information from

204
00:12:21,490 --> 00:12:26,220
detector 1 to detector 2 through the

205
00:12:23,409 --> 00:12:29,879
source faster than the speed of light

206
00:12:26,220 --> 00:12:32,620
the thing at the top is a palindrome

207
00:12:29,879 --> 00:12:35,559
which reads the same for word as it does

208
00:12:32,620 --> 00:12:39,129
backwards and here I'm proposing that we

209
00:12:35,559 --> 00:12:41,289
have another hypothesis was a time

210
00:12:39,129 --> 00:12:44,350
reversal of cause and effect

211
00:12:41,289 --> 00:12:49,980
we have detector one has a causal event

212
00:12:44,350 --> 00:12:52,389
which causes the appearance of a single

213
00:12:49,980 --> 00:12:55,360
polarization state which then wrote

214
00:12:52,389 --> 00:12:57,669

retro causally will propagate back to

215

00:12:55,360 --> 00:13:00,459
the source and cause that same

216

00:12:57,669 --> 00:13:03,719
polarization state to appear at the

217

00:13:00,458 --> 00:13:07,059
source which then comes forward to

218

00:13:03,720 --> 00:13:10,690
detector 2 this is time reversal of

219

00:13:07,059 --> 00:13:13,989
cause and effect and physicists go wild

220

00:13:10,690 --> 00:13:17,339
over this they just cannot encompass

221

00:13:13,990 --> 00:13:20,698
that however I like this because

222

00:13:17,339 --> 00:13:26,740
everything stays within the light cone

223

00:13:20,698 --> 00:13:29,679
everything is contiguous and it is

224

00:13:26,740 --> 00:13:31,778
relativistically invariant and this

225

00:13:29,679 --> 00:13:34,059
contrast was something that Pamela said

226

00:13:31,778 --> 00:13:39,730
earlier this morning that it doesn't

227

00:13:34,059 --> 00:13:40,949
satisfy relativity this scheme does the

228

00:13:39,730 --> 00:13:48,580
relativistic

229
00:13:40,950 --> 00:13:54,220
transformations will retain the same the

230
00:13:48,580 --> 00:13:56,860
same state finally you have to act ask

231
00:13:54,220 --> 00:14:01,629
which detector is causal and which is

232
00:13:56,860 --> 00:14:04,419
affected and I my hypothesis is that the

233
00:14:01,629 --> 00:14:11,590
both detectors participate in causality

234
00:14:04,419 --> 00:14:13,569
and if you have an emergence of a of a

235
00:14:11,590 --> 00:14:16,930
strong effect at either of the two

236
00:14:13,570 --> 00:14:21,570
detectors this thing can emerge on the

237
00:14:16,929 --> 00:14:26,589
macroscopic level and would cause a

238
00:14:21,570 --> 00:14:30,160
paranormal effect to occur so I submit

239
00:14:26,590 --> 00:14:37,840
that this is this is a source of

240
00:14:30,159 --> 00:14:39,659
paranormal effects I also submit that my

241
00:14:37,840 --> 00:14:42,540
time is up

242
00:14:39,659 --> 00:14:44,939
and I quit okay I'm open to questions

243
00:14:42,539 --> 00:14:52,559
and then we can go onto our non-local

244
00:14:44,940 --> 00:14:55,290
lunches if there are any questions I

245
00:14:52,559 --> 00:14:57,959
hope they're the right ones we do have a

246
00:14:55,289 --> 00:15:00,269
few minutes for questions even though

247
00:14:57,960 --> 00:15:02,070
our stomachs are growling yeah it must

248
00:15:00,269 --> 00:15:09,360
have been the reason I decided at 12

249
00:15:02,070 --> 00:15:11,310
o'clock we have to go eat okay well I

250
00:15:09,360 --> 00:15:13,019
thought that was very interesting data

251
00:15:11,309 --> 00:15:14,279
and I wondered if you had considered the

252
00:15:13,019 --> 00:15:16,740
possibility that there would be a

253
00:15:14,279 --> 00:15:19,019
quantum mechanical coupling or

254
00:15:16,740 --> 00:15:21,560
entanglement between the consciousness

255
00:15:19,019 --> 00:15:25,519
of the experimenter and the detectors

256
00:15:21,559 --> 00:15:28,799
something I didn't quite get to is that

257

00:15:25,519 --> 00:15:31,199
detector one may abet may be affected by

258
00:15:28,799 --> 00:15:34,109
what I call conscious observational

259
00:15:31,200 --> 00:15:37,440
causality and which others have called

260
00:15:34,110 --> 00:15:40,649
mental intention so that consciousness

261
00:15:37,440 --> 00:15:43,260
enters in at one or the other of the

262
00:15:40,649 --> 00:15:45,240
detectors one of the other sites causes

263
00:15:43,259 --> 00:15:49,860
a reversal of time and effect to

264
00:15:45,240 --> 00:15:52,440
propagate forward to the other site say

265
00:15:49,860 --> 00:15:53,899
detector to hope that answers that

266
00:15:52,440 --> 00:15:56,550
question

267
00:15:53,899 --> 00:15:59,250
if you read the many people that have

268
00:15:56,549 --> 00:16:03,209
commented on this whole argument you'll

269
00:15:59,250 --> 00:16:05,279
find a lot of people say that the bells

270
00:16:03,210 --> 00:16:07,500
inequality and ass pay experiments

271
00:16:05,279 --> 00:16:10,409

proved that Einsteins argument an EPR

272

00:16:07,500 --> 00:16:13,049

that quantum mechanics is incomplete was

273

00:16:10,409 --> 00:16:17,339

correct but you'll find just as many

274

00:16:13,049 --> 00:16:20,039

physicists say it's incorrect is quantum

275

00:16:17,340 --> 00:16:23,160

mechanics complete or not in your

276

00:16:20,039 --> 00:16:27,719

opinion no I don't believe it is

277

00:16:23,159 --> 00:16:30,419

complete because we do not have at this

278

00:16:27,720 --> 00:16:33,120

point an explanation for the randomness

279

00:16:30,419 --> 00:16:35,279

of cause of causality that occurs in

280

00:16:33,120 --> 00:16:38,210

quantum mechanics I believe that that

281

00:16:35,279 --> 00:16:41,970

randomness is connected with the

282

00:16:38,210 --> 00:16:45,120

conscious underworld so to speak the

283

00:16:41,970 --> 00:16:47,460

collective unconscious and and the

284

00:16:45,120 --> 00:16:53,190

consciousness that pervades our whole

285

00:16:47,460 --> 00:16:56,129

being so the simple answer is that it is

286
00:16:53,190 --> 00:16:58,500
complete but we need to branch off in

287
00:16:56,129 --> 00:17:02,549
another direction to find an alternate

288
00:16:58,500 --> 00:17:05,939
theory so for people googling all this

289
00:17:02,549 --> 00:17:09,529
there's Feynman wheeler to look up and

290
00:17:05,939 --> 00:17:12,150
Cramer transactional and I wonder if

291
00:17:09,529 --> 00:17:15,529
this you're just applying that to

292
00:17:12,150 --> 00:17:19,829
paranormal or is this a separate thing

293
00:17:15,529 --> 00:17:24,269
the Fineman wheeler work as I know it

294
00:17:19,828 --> 00:17:28,220
did involve a an advanced wave and a

295
00:17:24,269 --> 00:17:31,470
retarded wave involving an

296
00:17:28,220 --> 00:17:35,059
electromagnetic interaction the advanced

297
00:17:31,470 --> 00:17:38,700
wave being the time reversed portion of

298
00:17:35,059 --> 00:17:41,730
cause-and-effect Fineman himself was

299
00:17:38,700 --> 00:17:49,559
unhappy with the outcome of that and he

300
00:17:41,730 --> 00:17:52,110
went on to to renormalization I believe

301
00:17:49,559 --> 00:17:56,250
as an alternative answer but I believe

302
00:17:52,109 --> 00:17:58,649
that the Fineman work on on the

303
00:17:56,250 --> 00:18:01,920
advancement on the advanced wave was

304
00:17:58,650 --> 00:18:08,850
valid and parallels what I've described

305
00:18:01,920 --> 00:18:11,220
here is that okay hi thanks for a good

306
00:18:08,849 --> 00:18:13,679
presentation I wonder if you're aware of

307
00:18:11,220 --> 00:18:15,779
the joy Kristen's paper from Oxford last

308
00:18:13,680 --> 00:18:18,060
year on upper bounds on quantum

309
00:18:15,779 --> 00:18:18,779
correlations and if you have any

310
00:18:18,059 --> 00:18:20,759
thoughts on that

311
00:18:18,779 --> 00:18:25,829
especially on what are the upper bounds

312
00:18:20,759 --> 00:18:28,079
for quantum correlations no I'm not

313
00:18:25,829 --> 00:18:29,519
familiar with that unless you lead me a

314

00:18:28,079 --> 00:18:32,519
little further I don't think I can

315
00:18:29,519 --> 00:18:38,129
comment on it if we're short on time

316
00:18:32,519 --> 00:18:40,460
maybe we should discuss it thank you

317
00:18:38,130 --> 00:18:40,460
chuck

318
00:18:40,490 --> 00:18:49,930
[Applause]

319
00:18:43,529 --> 00:18:49,930
[Music]

320
00:18:58,900 --> 00:19:00,960
you