

1  
00:00:00,490 --> 00:00:08,529  
[Music]

2  
00:00:16,089 --> 00:00:25,160  
[Music]

3  
00:00:22,059 --> 00:00:27,079  
thank you very much it's an honor to be

4  
00:00:25,160 --> 00:00:28,368  
here and so many great presentations

5  
00:00:27,079 --> 00:00:33,410  
this morning I'm really pleased to be

6  
00:00:28,368 --> 00:00:37,100  
part of this and in response to the last

7  
00:00:33,409 --> 00:00:39,769  
gentleman Brennen what I'll be talking

8  
00:00:37,100 --> 00:00:41,660  
about today would would affect the

9  
00:00:39,770 --> 00:00:43,450  
interpretation I would want to make for

10  
00:00:41,659 --> 00:00:48,439  
those pseudo re G's rather than

11  
00:00:43,450 --> 00:00:50,390  
precognition of what the possible states

12  
00:00:48,439 --> 00:00:52,579  
of the art of the pseudo re G could be I

13  
00:00:50,390 --> 00:00:54,770  
wouldn't want to suggest the way I look

14  
00:00:52,579 --> 00:00:56,630  
at it would be a retroactive I'm gonna

15  
00:00:54,770 --> 00:00:57,829  
suggest that the collapse of that

16  
00:00:56,630 --> 00:01:00,079  
particular system into that particular

17  
00:00:57,829 --> 00:01:02,660  
state at that time is a relational

18  
00:01:00,079 --> 00:01:06,319  
process relative to you the experimenter

19  
00:01:02,659 --> 00:01:09,228  
and so therefore it could be a process

20  
00:01:06,319 --> 00:01:11,868  
of retro actively affecting the actual

21  
00:01:09,228 --> 00:01:14,780  
time of the initiation of that pseudo re

22  
00:01:11,868 --> 00:01:16,280  
G rather than Precog recognizing what

23  
00:01:14,780 --> 00:01:18,679  
it's going to be and then choosing that

24  
00:01:16,280 --> 00:01:19,759  
time in the present so and I think you

25  
00:01:18,679 --> 00:01:22,159  
could distinguish between those by

26  
00:01:19,759 --> 00:01:25,638  
running a experiment may be modeled

27  
00:01:22,159 --> 00:01:27,920  
after Helmut Smith's work because the

28  
00:01:25,638 --> 00:01:29,509  
the data set is known in advance right

29

00:01:27,920 --> 00:01:31,429  
because it's generated by a mathematical

30  
00:01:29,509 --> 00:01:33,228  
function at time zero the whole data set

31  
00:01:31,429 --> 00:01:35,539  
is known and can be analyzed in advance

32  
00:01:33,228 --> 00:01:36,528  
of the experiment being complete so

33  
00:01:35,539 --> 00:01:38,629  
anyway just some thoughts and I'd love

34  
00:01:36,528 --> 00:01:41,599  
to talk with you Brennan later thank you

35  
00:01:38,629 --> 00:01:43,879  
for the great presentation is the red

36  
00:01:41,599 --> 00:01:45,408  
button the light okay great so I'm going

37  
00:01:43,879 --> 00:01:46,429  
to talk about relational collapse how

38  
00:01:45,409 --> 00:01:47,569  
many of you know what collapse of the

39  
00:01:46,429 --> 00:01:49,789  
wavefunction is in quantum mechanics

40  
00:01:47,569 --> 00:01:52,639  
that concept okay how many of you know

41  
00:01:49,789 --> 00:01:54,560  
what relational collapse is relational

42  
00:01:52,638 --> 00:01:56,598  
collapse is the opposite of objective

43  
00:01:54,560 --> 00:02:00,219

collapse objective collapse is the idea

44

00:01:56,599 --> 00:02:02,810

that a quantum mechanical system given a

45

00:02:00,218 --> 00:02:05,899

plethora of multiple possible states

46

00:02:02,810 --> 00:02:07,278

would take an objective single state as

47

00:02:05,899 --> 00:02:09,590

a result of a measurement by an

48

00:02:07,278 --> 00:02:11,620

individual and that objective state has

49

00:02:09,590 --> 00:02:14,090

some kind of ontological status of being

50

00:02:11,620 --> 00:02:16,759

actually real for everybody everywhere

51

00:02:14,090 --> 00:02:18,110

at that moment rather than relational

52

00:02:16,759 --> 00:02:20,568

collapse which means relative to the

53

00:02:18,110 --> 00:02:23,840

observer so if you're familiar with

54

00:02:20,568 --> 00:02:25,369

friend concept that if if Daniel makes

55

00:02:23,840 --> 00:02:28,459

it experimental measurement in the lab

56

00:02:25,370 --> 00:02:30,200

and I'm outside of the lab when I enter

57

00:02:28,459 --> 00:02:31,938

the lab or the relational model would

58  
00:02:30,199 --> 00:02:33,408  
say that both Daniel and the

59  
00:02:31,938 --> 00:02:35,060  
experimental results are in a

60  
00:02:33,408 --> 00:02:37,128  
superposition position state together

61  
00:02:35,060 --> 00:02:40,699  
that they're correlated but the actual

62  
00:02:37,128 --> 00:02:42,468  
reality of that result is not actually

63  
00:02:40,699 --> 00:02:44,419  
determined for me as the outside

64  
00:02:42,468 --> 00:02:47,658  
observer and that is the relational

65  
00:02:44,419 --> 00:02:49,759  
model okay so I'm gonna use special

66  
00:02:47,658 --> 00:02:52,399  
relativity today to try and demonstrate

67  
00:02:49,759 --> 00:02:54,199  
to you that the relational model is the

68  
00:02:52,400 --> 00:02:57,530  
only viable interpretation of quantum

69  
00:02:54,199 --> 00:03:00,459  
mechanics that matches with special

70  
00:02:57,530 --> 00:03:02,959  
relativity which is a pretty stringent

71  
00:03:00,459 --> 00:03:07,878  
criteria because we know the special

72

00:03:02,959 --> 00:03:09,229  
relativity is correct so it's gonna it's

73

00:03:07,878 --> 00:03:10,578  
going to weed out about half of the

74

00:03:09,229 --> 00:03:12,108  
interpretations of quantum mechanics

75

00:03:10,579 --> 00:03:13,730  
which is something that we have not been

76

00:03:12,109 --> 00:03:15,019  
able to do yet currently all

77

00:03:13,729 --> 00:03:18,229  
interpretations of quantum mechanics are

78

00:03:15,019 --> 00:03:19,459  
equally relevant so hopefully we'll be

79

00:03:18,229 --> 00:03:20,750  
able to I'll be able to demonstrate to

80

00:03:19,459 --> 00:03:23,090  
you in a convincing way that that is the

81

00:03:20,750 --> 00:03:25,219  
case so the overview is at special

82

00:03:23,090 --> 00:03:27,259  
relativity from 1905 leads to the

83

00:03:25,219 --> 00:03:28,810  
conclusion any definite reality must be

84

00:03:27,258 --> 00:03:32,059  
described relative to another observer

85

00:03:28,810 --> 00:03:33,889  
this is called relationality and the

86

00:03:32,060 --> 00:03:37,370  
conclusion at least my version of

87  
00:03:33,889 --> 00:03:42,159  
relationality is that physical reality

88  
00:03:37,370 --> 00:03:44,299  
is secondary in consciousness is primary

89  
00:03:42,158 --> 00:03:46,489  
I'm not the first one to talk about this

90  
00:03:44,299 --> 00:03:48,438  
this is quite a bit of literature and

91  
00:03:46,489 --> 00:03:50,449  
ideas out there on this topic I'm gonna

92  
00:03:48,438 --> 00:03:53,508  
try and show it rigorously that this has

93  
00:03:50,449 --> 00:03:55,699  
to be the case so I'll start with the

94  
00:03:53,508 --> 00:03:57,108  
derivation so many of the great advances

95  
00:03:55,699 --> 00:03:58,759  
in physics have been a result of people

96  
00:03:57,109 --> 00:04:01,340  
studying light and all of these people

97  
00:03:58,758 --> 00:04:03,408  
has studied light as a major part of

98  
00:04:01,340 --> 00:04:07,098  
their careers so we've got iron stein

99  
00:04:03,408 --> 00:04:10,548  
Max Planck Newton Thomas Young Maxwell

100  
00:04:07,098 --> 00:04:11,750

and Huygens and we still don't know what

101

00:04:10,549 --> 00:04:14,299

light is and that's the beauty of it

102

00:04:11,750 --> 00:04:17,238

it's it's this central piece of physics

103

00:04:14,299 --> 00:04:18,829

that is is still not understood we've

104

00:04:17,238 --> 00:04:20,538

got lots of models and all these models

105

00:04:18,829 --> 00:04:22,668

work very well for specific experiences

106

00:04:20,538 --> 00:04:24,709

but there's others stuff about light it

107

00:04:22,668 --> 00:04:27,589

isn't not understood so let's talk about

108

00:04:24,709 --> 00:04:31,250

the Lorentz transformation for a simple

109

00:04:27,589 --> 00:04:32,359

non light example for muons these are

110

00:04:31,250 --> 00:04:34,038

particles that are generated in the

111

00:04:32,360 --> 00:04:34,490

upper atmosphere I'm going to try and

112

00:04:34,038 --> 00:04:36,228

use them

113

00:04:34,490 --> 00:04:37,939

to explain to you how special relativity

114

00:04:36,228 --> 00:04:40,189

works for those of you who might not be

115  
00:04:37,939 --> 00:04:42,110  
as familiar and the main result we're

116  
00:04:40,189 --> 00:04:43,098  
going to talk about is time dilation how

117  
00:04:42,110 --> 00:04:45,590  
many are familiar with the idea that

118  
00:04:43,098 --> 00:04:47,089  
time is dilated for objects in reference

119  
00:04:45,589 --> 00:04:50,388  
frames that are moving close to the

120  
00:04:47,089 --> 00:04:53,209  
speed of light okay relative to me the

121  
00:04:50,389 --> 00:04:55,788  
observer so for a muon that's generated

122  
00:04:53,209 --> 00:04:58,250  
in the upper atmosphere by cosmic

123  
00:04:55,788 --> 00:05:00,430  
processes a muon has a very short

124  
00:04:58,250 --> 00:05:02,598  
half-life of about two microseconds so

125  
00:05:00,430 --> 00:05:03,918  
 $\mu_1$  is going to decay very quickly

126  
00:05:02,598 --> 00:05:06,379  
according to natural spontaneous

127  
00:05:03,918 --> 00:05:07,639  
physical processes that we don't I don't

128  
00:05:06,379 --> 00:05:09,680  
think we fully understand or actually

129  
00:05:07,639 --> 00:05:11,509  
probably do but I'm not a particle

130  
00:05:09,680 --> 00:05:12,978  
physicist so I don't understand them but

131  
00:05:11,509 --> 00:05:14,930  
I know that after about two microseconds

132  
00:05:12,978 --> 00:05:21,949  
they decay and so it would look

133  
00:05:14,930 --> 00:05:23,389  
something like this okay so what in my

134  
00:05:21,949 --> 00:05:26,288  
model I mean this is just a metaphor

135  
00:05:23,389 --> 00:05:29,300  
it's vibrating Wow mwah mwah mwah and

136  
00:05:26,288 --> 00:05:33,918  
explodes right that's my model for the

137  
00:05:29,300 --> 00:05:35,300  
decay of the muon and what I'm trying to

138  
00:05:33,918 --> 00:05:37,008  
demonstrate here is that it has a

139  
00:05:35,300 --> 00:05:39,169  
certain process time there's a certain

140  
00:05:37,009 --> 00:05:42,590  
physical process that's governing this

141  
00:05:39,168 --> 00:05:44,389  
behavior and so what you would expect

142  
00:05:42,589 --> 00:05:46,008  
for a muon even if it's traveling fast

143

00:05:44,389 --> 00:05:47,930  
from the upper atmosphere it's only two

144  
00:05:46,009 --> 00:05:50,810  
microseconds so it doesn't get very far

145  
00:05:47,930 --> 00:05:52,009  
and so this is what you expect it

146  
00:05:50,810 --> 00:05:55,750  
wouldn't get very far wouldn't make it

147  
00:05:52,009 --> 00:05:59,538  
to the surface of the earth and again

148  
00:05:55,750 --> 00:06:03,319  
one WOM WOM WOM okay but what actually

149  
00:05:59,538 --> 00:06:07,598  
happens is different because time is

150  
00:06:03,319 --> 00:06:16,669  
dilated for the process time of the muon

151  
00:06:07,598 --> 00:06:19,189  
it looks like this Wow okay so what the

152  
00:06:16,668 --> 00:06:20,598  
process time is dilated is actually

153  
00:06:19,189 --> 00:06:21,968  
slowed down from the reference frame of

154  
00:06:20,598 --> 00:06:24,439  
me sitting on the earth

155  
00:06:21,968 --> 00:06:25,908  
this is a basic result from special

156  
00:06:24,439 --> 00:06:28,339  
relativity that was confirmed in the 60s

157  
00:06:25,908 --> 00:06:29,598

and we observed many of these muons of

158

00:06:28,339 --> 00:06:31,399

the surface of the earth which indicates

159

00:06:29,598 --> 00:06:33,550

that yes indeed time is dilated for

160

00:06:31,399 --> 00:06:36,739

these muons now what's important here in

161

00:06:33,550 --> 00:06:39,590

this illustration is that I am talking

162

00:06:36,740 --> 00:06:42,560

about me as the observer on the surface

163

00:06:39,589 --> 00:06:44,028

of the earth I didn't put a clock in the

164

00:06:42,560 --> 00:06:46,759

reference frame of the muon I didn't

165

00:06:44,028 --> 00:06:47,839

talk about the the time as experienced

166

00:06:46,759 --> 00:06:49,759

by the muon

167

00:06:47,839 --> 00:06:52,129

or the time relative to the reference

168

00:06:49,759 --> 00:06:56,050

frame of the muon what I'm discussing is

169

00:06:52,129 --> 00:06:59,918

the time that I measure sitting on earth

170

00:06:56,050 --> 00:07:02,150

and what I'm measuring are two things an

171

00:06:59,918 --> 00:07:04,069

earth observer can measure two different

172  
00:07:02,149 --> 00:07:05,839  
time quantities the first one is the

173  
00:07:04,069 --> 00:07:07,909  
amount of time it appears it actually

174  
00:07:05,839 --> 00:07:09,138  
takes the muon to travel from the upper

175  
00:07:07,910 --> 00:07:12,290  
atmosphere to the lower atmosphere

176  
00:07:09,139 --> 00:07:14,449  
that's from point A to point B and I

177  
00:07:12,290 --> 00:07:15,889  
measure that I might stopwatch and I

178  
00:07:14,449 --> 00:07:19,160  
write down the time that it takes might

179  
00:07:15,889 --> 00:07:20,540  
take a second for that to happen that's

180  
00:07:19,160 --> 00:07:23,150  
the time for me want to get from A to B

181  
00:07:20,540 --> 00:07:25,069  
the second thing I can measure however

182  
00:07:23,149 --> 00:07:29,539  
is the process time for the decay of the

183  
00:07:25,069 --> 00:07:32,509  
muon and as we noted the process time

184  
00:07:29,540 --> 00:07:34,490  
for the decay of the muon it's obvious

185  
00:07:32,509 --> 00:07:36,319  
to us that it was dilated because we

186  
00:07:34,490 --> 00:07:38,600  
know from other experiments that it

187  
00:07:36,319 --> 00:07:40,279  
takes two microseconds to decay and in

188  
00:07:38,600 --> 00:07:41,600  
this example in this experience it

189  
00:07:40,279 --> 00:07:45,079  
lasted for much longer than that

190  
00:07:41,600 --> 00:07:48,129  
and so we we can infer that the process

191  
00:07:45,079 --> 00:07:50,899  
time of the muon has been dilated the

192  
00:07:48,129 --> 00:07:53,180  
key point is that I am a earthbound

193  
00:07:50,899 --> 00:07:55,219  
observer an inertial reference frame

194  
00:07:53,180 --> 00:07:56,780  
making a measurement of this muon it

195  
00:07:55,220 --> 00:07:58,580  
never once did I try and put myself in

196  
00:07:56,779 --> 00:08:00,709  
the reference frame of the muon which is

197  
00:07:58,579 --> 00:08:02,000  
what we typically try to do in in you

198  
00:08:00,709 --> 00:08:05,449  
know discussing relativity with the

199  
00:08:02,000 --> 00:08:07,098  
yardsticks and and stopwatches in this

200

00:08:05,449 --> 00:08:08,329  
case it's good though smaadhahl z' of

201  
00:08:07,098 --> 00:08:09,529  
large sticks and stop watches are gonna

202  
00:08:08,329 --> 00:08:11,269  
get in our way because all I'm really

203  
00:08:09,529 --> 00:08:12,799  
doing is an Earthbound observer making a

204  
00:08:11,269 --> 00:08:16,939  
measurement of these two time quantities

205  
00:08:12,800 --> 00:08:18,620  
relevant to the new one so for a given

206  
00:08:16,939 --> 00:08:20,060  
time measured by me less and less time

207  
00:08:18,620 --> 00:08:20,389  
passes for the muon from my point of

208  
00:08:20,060 --> 00:08:24,740  
view

209  
00:08:20,389 --> 00:08:28,160  
now here's my real point what I'm about

210  
00:08:24,740 --> 00:08:30,650  
to say for half of the physicists I talk

211  
00:08:28,160 --> 00:08:32,028  
to you about this they'll they'll say

212  
00:08:30,649 --> 00:08:35,269  
you know skip that whole part of your

213  
00:08:32,028 --> 00:08:36,830  
talk it's obvious that was what one

214  
00:08:35,269 --> 00:08:39,679

physicist said to me at the end of the

215

00:08:36,830 --> 00:08:43,070

talk at the conference down in San Diego

216

00:08:39,679 --> 00:08:44,088

and then the other half will say I don't

217

00:08:43,070 --> 00:08:45,250

agree with that that doesn't make any

218

00:08:44,089 --> 00:08:48,050

sense it's meaningless

219

00:08:45,250 --> 00:08:51,379

so I've decided that before moving on I

220

00:08:48,049 --> 00:08:53,299

need to spend time figuring out how did

221

00:08:51,379 --> 00:08:56,000

how to present this in a way that is

222

00:08:53,299 --> 00:08:58,039

convincing and makes sense to people so

223

00:08:56,000 --> 00:09:00,049

the point is that I can replace the muon

224

00:08:58,039 --> 00:09:01,528

with a light particle now what we're

225

00:09:00,049 --> 00:09:03,778

talking about is just a system

226

00:09:01,528 --> 00:09:06,448

it's moving at a given speed relative to

227

00:09:03,778 --> 00:09:07,769

me the relative speed of the two systems

228

00:09:06,448 --> 00:09:09,659

that's what Einstein talks about in his

229  
00:09:07,769 --> 00:09:10,620  
initial paper in 1905 is the relative

230  
00:09:09,659 --> 00:09:13,110  
speed of the two systems

231  
00:09:10,620 --> 00:09:14,879  
he doesn't say inertial at all in that

232  
00:09:13,110 --> 00:09:16,528  
paper he doesn't talk about the

233  
00:09:14,879 --> 00:09:19,289  
reference frame and he says talks about

234  
00:09:16,528 --> 00:09:21,688  
reference to him I think one time and he

235  
00:09:19,289 --> 00:09:25,110  
talks about the the relative speed of

236  
00:09:21,688 --> 00:09:26,248  
the two systems and so it doesn't appear

237  
00:09:25,110 --> 00:09:27,688  
to me that there's any problem with

238  
00:09:26,249 --> 00:09:29,759  
talking about light it's simply an

239  
00:09:27,688 --> 00:09:31,379  
entity that's moving past me at a

240  
00:09:29,759 --> 00:09:33,949  
certain speed and that speed happens to

241  
00:09:31,379 --> 00:09:36,180  
be  $C$  the speed of light but I'm not

242  
00:09:33,948 --> 00:09:37,859  
putting myself in the quote unquote

243  
00:09:36,179 --> 00:09:40,859  
reference frame of the Photon you can't

244  
00:09:37,860 --> 00:09:43,259  
do that what I'm doing is measuring on

245  
00:09:40,860 --> 00:09:44,909  
earth from an Earthbound position the

246  
00:09:43,259 --> 00:09:48,930  
properties of this entity that's moving

247  
00:09:44,909 --> 00:09:50,490  
past me so what we obtain very obviously

248  
00:09:48,929 --> 00:09:52,138  
from the equations of the Lorentz

249  
00:09:50,490 --> 00:09:54,329  
transformation is that the process time

250  
00:09:52,139 --> 00:10:00,539  
where the time of evolution of the light

251  
00:09:54,328 --> 00:10:01,769  
is equal to zero so if I'm able to

252  
00:10:00,539 --> 00:10:04,528  
convince you of that

253  
00:10:01,769 --> 00:10:07,769  
then the in the implications of that are

254  
00:10:04,528 --> 00:10:11,370  
very very interesting and we'll try and

255  
00:10:07,769 --> 00:10:16,649  
get there so the implication to me is

256  
00:10:11,370 --> 00:10:21,929  
something like this light is timeless we

257

00:10:16,649 --> 00:10:23,399  
might also say time is meaningless when

258  
00:10:21,929 --> 00:10:25,138  
we were discussing the process time of

259  
00:10:23,399 --> 00:10:26,879  
light it's hard to talk about something

260  
00:10:25,139 --> 00:10:28,620  
as meaningless or it's hard to talk

261  
00:10:26,879 --> 00:10:30,720  
about timelessness from the perspective

262  
00:10:28,620 --> 00:10:33,299  
of you and I who are in space and time

263  
00:10:30,720 --> 00:10:36,059  
and that's how we do our physics and

264  
00:10:33,299 --> 00:10:38,729  
that's why this is so hard to talk about

265  
00:10:36,058 --> 00:10:40,558  
in physics but yet I believe that we can

266  
00:10:38,730 --> 00:10:42,269  
show that it's an important conversation

267  
00:10:40,558 --> 00:10:45,808  
to have and that there are implications

268  
00:10:42,269 --> 00:10:47,428  
that can be measured so possible

269  
00:10:45,808 --> 00:10:50,578  
objections are light does not have a

270  
00:10:47,428 --> 00:10:53,669  
perspective that's true light is not an

271  
00:10:50,578 --> 00:10:54,870

inertial reference frame that's true no

272

00:10:53,669 --> 00:10:57,599  
clocks can move at light speed

273

00:10:54,870 --> 00:11:01,769  
that's true and light cannot experience

274

00:10:57,600 --> 00:11:04,800  
time that's true but I didn't say any of

275

00:11:01,769 --> 00:11:06,209  
those things okay and that's what I'm

276

00:11:04,799 --> 00:11:08,789  
trying to get across I'm working with a

277

00:11:06,208 --> 00:11:11,068  
physicist right now just talking weakly

278

00:11:08,789 --> 00:11:12,449  
and he's making sure I don't use words

279

00:11:11,068 --> 00:11:15,209  
that point to

280

00:11:12,450 --> 00:11:17,460  
any of these things I'm not saying what

281

00:11:15,210 --> 00:11:19,290  
does light measure as its timeframe or

282

00:11:17,460 --> 00:11:21,150  
what is the experience of light though

283

00:11:19,289 --> 00:11:22,649  
what is how does light pass for time

284

00:11:21,149 --> 00:11:24,689  
none of those things make sense to talk

285

00:11:22,649 --> 00:11:26,639  
about what I'm saying is trying to

286  
00:11:24,690 --> 00:11:29,340  
define the process time for light that

287  
00:11:26,639 --> 00:11:34,220  
that governs how it evolves and saying

288  
00:11:29,340 --> 00:11:36,899  
that that value must be zero and so

289  
00:11:34,220 --> 00:11:42,240  
light cannot evolve from point A to

290  
00:11:36,899 --> 00:11:45,179  
point B it simply cannot so the lumens

291  
00:11:42,240 --> 00:11:47,519  
Lorentz transformation says for me an

292  
00:11:45,179 --> 00:11:49,319  
Earthbound observer the light definitely

293  
00:11:47,519 --> 00:11:51,899  
changes it goes from point A in the

294  
00:11:49,320 --> 00:11:54,510  
light bulb to point B on the clock on

295  
00:11:51,899 --> 00:11:56,100  
the wall to point C on my eyes those are

296  
00:11:54,509 --> 00:11:59,460  
three events that are separate in space

297  
00:11:56,100 --> 00:12:01,409  
and time for me the observer but to talk

298  
00:11:59,460 --> 00:12:04,560  
about that as those being separate

299  
00:12:01,409 --> 00:12:05,360  
events for the actual light doesn't make

300  
00:12:04,559 --> 00:12:07,500  
any sense

301  
00:12:05,360 --> 00:12:10,759  
because light cannot evolve from point A

302  
00:12:07,500 --> 00:12:13,500  
to point B a very quick technical point

303  
00:12:10,759 --> 00:12:17,009  
these are what I would call origins

304  
00:12:13,500 --> 00:12:19,110  
centered events what light leaving the

305  
00:12:17,009 --> 00:12:21,090  
light bulb traveling to the clock and

306  
00:12:19,110 --> 00:12:25,440  
hitting the eyeball call them a B and C

307  
00:12:21,090 --> 00:12:26,790  
they all happen right where the right

308  
00:12:25,440 --> 00:12:34,590  
where the bulb it right where the light

309  
00:12:26,789 --> 00:12:36,779  
is you sure this video so a B C and for

310  
00:12:34,590 --> 00:12:39,480  
events like that the distance between

311  
00:12:36,779 --> 00:12:41,939  
the events divided by the time taken

312  
00:12:39,480 --> 00:12:44,070  
between the events happens to be a

313  
00:12:41,940 --> 00:12:46,790  
special case where it's equal to the

314

00:12:44,070 --> 00:12:48,810  
relative speed of the two systems

315  
00:12:46,789 --> 00:12:49,980  
because those events are happening when

316  
00:12:48,809 --> 00:12:53,219  
the light actually arrives at those

317  
00:12:49,980 --> 00:12:54,570  
points so this is a technical piece that

318  
00:12:53,220 --> 00:12:56,279  
allows us to make a modification to

319  
00:12:54,570 --> 00:12:59,250  
Lorentz transformation here's the

320  
00:12:56,279 --> 00:13:03,179  
Lorentz transformation where  $T$  is the

321  
00:12:59,250 --> 00:13:05,490  
time measured by me for the light to

322  
00:13:03,179 --> 00:13:06,959  
move from point A to point B  $L$  is the

323  
00:13:05,490 --> 00:13:08,990  
distance I measure for the light to go

324  
00:13:06,960 --> 00:13:12,840  
to point eight a point A to point B and

325  
00:13:08,990 --> 00:13:13,649  
 $T$  prime is the time the process time of

326  
00:13:12,840 --> 00:13:15,030  
the light this is what we're talking

327  
00:13:13,649 --> 00:13:17,669  
about is the process time of the light

328  
00:13:15,029 --> 00:13:21,149

and  $V$  is the relative speed of the two

329

00:13:17,669 --> 00:13:24,120  
systems when we plug in  $V$  equals  $L$  over

330

00:13:21,149 --> 00:13:25,659  
 $T$  this actually changes the equation

331

00:13:24,120 --> 00:13:29,919  
from being one which becomes

332

00:13:25,659 --> 00:13:31,240  
infinite to one which becomes zero if

333

00:13:29,919 --> 00:13:34,209  
this if it was infinite it would be

334

00:13:31,240 --> 00:13:36,100  
undefined and meaningless in physics but

335

00:13:34,210 --> 00:13:37,360  
in this case instead of  $\gamma$  on the

336

00:13:36,100 --> 00:13:38,680  
left hand side you see  $\gamma$  there that

337

00:13:37,360 --> 00:13:41,529  
usually blows up to infinity when you

338

00:13:38,679 --> 00:13:46,329  
get to Lightspeed it actually cancels

339

00:13:41,529 --> 00:13:49,089  
out with the term on top and you get

340

00:13:46,330 --> 00:13:50,920  
essentially  $T$  over  $\gamma$  or  $T$  capital  $T$

341

00:13:49,090 --> 00:13:52,360  
times  $1 - V^2$  over  $C^2$

342

00:13:50,919 --> 00:13:54,159  
and the reason I put this here is

343  
00:13:52,360 --> 00:13:56,289  
because it's it simply indicates that

344  
00:13:54,159 --> 00:13:58,360  
when you plug in  $V$  equals  $C$  at this

345  
00:13:56,289 --> 00:14:00,250  
point you get a very nice easy result

346  
00:13:58,360 --> 00:14:02,500  
rather than anything that blows up to

347  
00:14:00,250 --> 00:14:05,159  
infinity and so you get that the process

348  
00:14:02,500 --> 00:14:07,000  
time for the light equals to zero

349  
00:14:05,159 --> 00:14:10,870  
interpreting that as another matter and

350  
00:14:07,000 --> 00:14:12,490  
and very challenging so I've said light

351  
00:14:10,870 --> 00:14:16,289  
as timeless and light cannot evolve from

352  
00:14:12,490 --> 00:14:19,120  
point A to point B and just a brief note

353  
00:14:16,289 --> 00:14:20,589  
Einstein said that you know you could

354  
00:14:19,120 --> 00:14:22,509  
object that you can't plug  $V$  equal  $C$

355  
00:14:20,590 --> 00:14:24,430  
into the Lorentz transform you can't do

356  
00:14:22,509 --> 00:14:26,049  
that for an object that has mass any

357  
00:14:24,429 --> 00:14:28,149  
kind of mass but we're talking about

358  
00:14:26,049 --> 00:14:30,339  
light here specifically and only light

359  
00:14:28,149 --> 00:14:32,829  
which has no rest mass and in Einstein's

360  
00:14:30,340 --> 00:14:34,509  
original paper he said for  $V$  equals  $C$

361  
00:14:32,830 --> 00:14:36,820  
all moving objects viewed from the

362  
00:14:34,509 --> 00:14:39,069  
stationary system shrivel up into plane

363  
00:14:36,820 --> 00:14:40,629  
figures which is essentially what we're

364  
00:14:39,070 --> 00:14:42,310  
talking about here for values greater

365  
00:14:40,629 --> 00:14:44,529  
than that of light our deliberations

366  
00:14:42,309 --> 00:14:46,209  
become meaningless it doesn't say that

367  
00:14:44,529 --> 00:14:48,429  
for the value of Lightspeed our

368  
00:14:46,210 --> 00:14:50,379  
deliberations are meaningless I think he

369  
00:14:48,429 --> 00:14:53,349  
would agree that it indicates that our

370  
00:14:50,379 --> 00:14:54,970  
deliberations become complicated but not

371

00:14:53,350 --> 00:14:57,940  
meaningless and we have to understand

372  
00:14:54,970 --> 00:15:00,580  
that use case they shrivel up into plane

373  
00:14:57,940 --> 00:15:03,000  
figures what did that mean to him what

374  
00:15:00,580 --> 00:15:03,000  
does that mean

375  
00:15:03,240 --> 00:15:08,169  
so is it valid to ask how would light

376  
00:15:05,769 --> 00:15:09,370  
registers events we interact with light

377  
00:15:08,169 --> 00:15:11,709  
and make various distinguishable

378  
00:15:09,370 --> 00:15:13,179  
measurements that affect it light is an

379  
00:15:11,710 --> 00:15:15,790  
entity that gets changed by our

380  
00:15:13,179 --> 00:15:17,199  
measurements so I do think it's a valid

381  
00:15:15,789 --> 00:15:19,599  
to ask how light registers our

382  
00:15:17,200 --> 00:15:22,270  
interactions with it and I don't have to

383  
00:15:19,600 --> 00:15:23,889  
say experiences our actions or anything

384  
00:15:22,269 --> 00:15:26,199  
like that I'm saying registers is a very

385  
00:15:23,889 --> 00:15:29,740

sort of physical word that doesn't have

386

00:15:26,200 --> 00:15:31,750

to do with anthropomorphism so what is

387

00:15:29,740 --> 00:15:33,549

timelessness how can light be timeless

388

00:15:31,750 --> 00:15:34,990

when we see it moving all the time we

389

00:15:33,549 --> 00:15:38,229

can measure light moving from point A to

390

00:15:34,990 --> 00:15:41,259

point B very precisely how

391

00:15:38,230 --> 00:15:42,610

can it be timeless well the conclusion I

392

00:15:41,259 --> 00:15:45,279

draw from this is that light does not

393

00:15:42,610 --> 00:15:47,560

actually move the Lorentz

394

00:15:45,279 --> 00:15:50,559

transformations say that space and time

395

00:15:47,559 --> 00:15:52,500

both become essentially zero whatever

396

00:15:50,559 --> 00:15:54,819

that means

397

00:15:52,500 --> 00:15:57,419

so light can't move it has nowhere to go

398

00:15:54,820 --> 00:15:59,470

it doesn't make any sense it's undefined

399

00:15:57,419 --> 00:16:02,370

the conclusion I draw is that light

400  
00:15:59,470 --> 00:16:05,889  
appears to have moved when its measured

401  
00:16:02,370 --> 00:16:09,929  
life always appears to move a distance  $L$

402  
00:16:05,889 --> 00:16:12,279  
in a time  $T$  given by the speed of light

403  
00:16:09,929 --> 00:16:13,839  
but only when you make a measurement you

404  
00:16:12,279 --> 00:16:17,230  
can't say anything about it other than

405  
00:16:13,840 --> 00:16:19,530  
that and so when I when I observe light

406  
00:16:17,230 --> 00:16:22,930  
after bouncing off a clock on the wall

407  
00:16:19,529 --> 00:16:24,429  
I'm observing it at a position and time

408  
00:16:22,929 --> 00:16:26,979  
as if it had traveled the intervening

409  
00:16:24,429 --> 00:16:28,870  
distance that doesn't mean it actually

410  
00:16:26,980 --> 00:16:31,120  
did travel the intervening distance in

411  
00:16:28,870 --> 00:16:34,629  
some kind of continuous way or absolute

412  
00:16:31,120 --> 00:16:36,909  
real way it means that it's measured to

413  
00:16:34,629 --> 00:16:39,939  
have done so when I actually make a

414  
00:16:36,909 --> 00:16:41,740  
measurement and if you see some

415  
00:16:39,940 --> 00:16:43,900  
similarities to quantum mechanics that's

416  
00:16:41,740 --> 00:16:45,519  
good because we actually arrived at this

417  
00:16:43,899 --> 00:16:47,919  
without invoking quantum mechanics at

418  
00:16:45,519 --> 00:16:49,269  
all the idea that the system doesn't

419  
00:16:47,919 --> 00:16:52,209  
have a definite state until a

420  
00:16:49,269 --> 00:16:54,189  
measurement is actually made is one of

421  
00:16:52,210 --> 00:16:55,450  
the central pieces of quantum mechanics

422  
00:16:54,190 --> 00:16:57,490  
but we are just talking about special

423  
00:16:55,450 --> 00:16:58,810  
relativity at this point and so it to me

424  
00:16:57,490 --> 00:16:59,980  
that there's it brings them together in

425  
00:16:58,809 --> 00:17:04,059  
a way it shows that they have a common

426  
00:16:59,980 --> 00:17:06,549  
origin or a common logic to them if you

427  
00:17:04,059 --> 00:17:07,960  
plug in the the T equals zero in there

428

00:17:06,549 --> 00:17:09,909  
what you get is a very trivial result

429  
00:17:07,960 --> 00:17:12,100  
which is that the distance and the time

430  
00:17:09,910 --> 00:17:14,170  
actually traveled by the light relative

431  
00:17:12,099 --> 00:17:15,369  
to me is given by the speed of light so

432  
00:17:14,170 --> 00:17:19,870  
the light always appears to move at the

433  
00:17:15,369 --> 00:17:23,229  
speed of light so here's the the

434  
00:17:19,869 --> 00:17:26,649  
question I want to ask you if light is

435  
00:17:23,230 --> 00:17:32,140  
timeless then the now light already

436  
00:17:26,650 --> 00:17:34,500  
exists in tomorrow so just take a minute

437  
00:17:32,140 --> 00:17:36,790  
to picture yourself on a sunny field

438  
00:17:34,500 --> 00:17:38,559  
it's a beautiful sunny day and you're

439  
00:17:36,789 --> 00:17:44,440  
feeling the the warmth of the light on

440  
00:17:38,559 --> 00:17:47,329  
your skin and that light is timeless so

441  
00:17:44,440 --> 00:17:50,330  
that very same light

442  
00:17:47,329 --> 00:17:52,250

is connected timelessly somehow to the

443

00:17:50,329 --> 00:17:53,678

two when it left the event of the light

444

00:17:52,250 --> 00:17:56,000

leaving the Sun eight minutes before

445

00:17:53,679 --> 00:17:59,740

it's also connected timelessly to the

446

00:17:56,000 --> 00:18:03,169

future how can anything that's timeless

447

00:17:59,740 --> 00:18:04,730

not be connected to all of time and some

448

00:18:03,169 --> 00:18:06,950

in some regard that the light that we're

449

00:18:04,730 --> 00:18:08,929

experiencing in the future is connected

450

00:18:06,950 --> 00:18:13,370

timelessly to the lights today it's hard

451

00:18:08,929 --> 00:18:15,110

to discuss it in physical words but if

452

00:18:13,369 --> 00:18:17,089

you contemplate timelessness I this is

453

00:18:15,109 --> 00:18:21,199

the conclusion I've come to the question

454

00:18:17,089 --> 00:18:22,759

is which tomorrow is it connected to if

455

00:18:21,200 --> 00:18:24,200

light is timeless which time which

456

00:18:22,759 --> 00:18:26,089

tomorrow is that connected to is the

457  
00:18:24,200 --> 00:18:30,048  
future predetermined it would seem that

458  
00:18:26,089 --> 00:18:31,699  
way but I would say no light exists in

459  
00:18:30,048 --> 00:18:33,440  
all the possible futures and so now

460  
00:18:31,700 --> 00:18:35,389  
we've landed on the conclusion that all

461  
00:18:33,440 --> 00:18:40,399  
these possible features exist that light

462  
00:18:35,388 --> 00:18:42,528  
is timelessly connected to and since

463  
00:18:40,398 --> 00:18:44,509  
light must always real aim remain

464  
00:18:42,528 --> 00:18:46,839  
timeless it can never objectively

465  
00:18:44,509 --> 00:18:49,250  
collapse to a single definite state if

466  
00:18:46,839 --> 00:18:51,500  
light ever objectively took a definite

467  
00:18:49,250 --> 00:18:56,808  
state then it would mean that I was

468  
00:18:51,500 --> 00:19:00,138  
changing the future of that light as

469  
00:18:56,808 --> 00:19:02,210  
well in some objective way which doesn't

470  
00:19:00,138 --> 00:19:06,319  
make sense with the principle that light

471  
00:19:02,210 --> 00:19:07,940  
would be timeless and so the where I

472  
00:19:06,319 --> 00:19:10,220  
take that is the relational collapse

473  
00:19:07,940 --> 00:19:14,058  
model the light only takes a definite

474  
00:19:10,220 --> 00:19:15,319  
state relative to me the observer and so

475  
00:19:14,058 --> 00:19:17,960  
any description is relative to an

476  
00:19:15,319 --> 00:19:19,730  
observer so compatible interpretations

477  
00:19:17,960 --> 00:19:22,460  
that use this idea of relational

478  
00:19:19,730 --> 00:19:25,308  
collapse many worlds many minds

479  
00:19:22,460 --> 00:19:27,440  
consistent histories relational quantum

480  
00:19:25,308 --> 00:19:28,940  
Bayesian ISM and decoherence Theory

481  
00:19:27,440 --> 00:19:30,798  
decoherence is not really an

482  
00:19:28,940 --> 00:19:34,460  
interpretation but it met it fits with

483  
00:19:30,798 --> 00:19:36,319  
this transactional to state vector

484  
00:19:34,460 --> 00:19:40,100  
formalism are both possibly compatible I

485

00:19:36,319 --> 00:19:41,210  
haven't figured it out yet incompatible

486  
00:19:40,099 --> 00:19:42,619  
interpretations and this is where I

487  
00:19:41,210 --> 00:19:44,690  
think it's very interesting and relevant

488  
00:19:42,619 --> 00:19:46,518  
the Penrose interpretation anything

489  
00:19:44,690 --> 00:19:47,990  
involving objective reduction or

490  
00:19:46,519 --> 00:19:51,940  
objective collapse doesn't fit this

491  
00:19:47,990 --> 00:19:55,130  
model grw the Copenhagen interpretation

492  
00:19:51,940 --> 00:19:56,659  
simply said that macroscopic can't be

493  
00:19:55,130 --> 00:19:58,309  
separate from microscopic if you follow

494  
00:19:56,659 --> 00:19:59,870  
this model that would that would imply

495  
00:19:58,308 --> 00:20:00,920  
some kind of objective reality that just

496  
00:19:59,869 --> 00:20:03,649  
can't be the case with

497  
00:20:00,920 --> 00:20:05,210  
Relativity de broglie-bohm von Oy Minh

498  
00:20:03,650 --> 00:20:06,800  
and the varmint stop and staff

499  
00:20:05,210 --> 00:20:08,240

interpretations although in discussion

500

00:20:06,799 --> 00:20:09,259

with Henry step I think we've might have

501

00:20:08,240 --> 00:20:14,049

brought them a little closer to the

502

00:20:09,259 --> 00:20:17,509

relational view so that's ongoing a

503

00:20:14,049 --> 00:20:19,579

definite objective world out there does

504

00:20:17,509 --> 00:20:21,559

not need consciousness but the

505

00:20:19,579 --> 00:20:26,809

relational world has a natural place for

506

00:20:21,559 --> 00:20:29,480

consciousness the observer so physical

507

00:20:26,809 --> 00:20:31,730

reality is secondary takes definite form

508

00:20:29,480 --> 00:20:36,920

inside consciousness and consciousness

509

00:20:31,730 --> 00:20:44,779

is primary thank you very much thank you

510

00:20:36,920 --> 00:20:46,160

very much thank you quick question and

511

00:20:44,779 --> 00:20:49,670

just just to mention I have a book that

512

00:20:46,160 --> 00:20:51,440

will be coming out in December and some

513

00:20:49,670 --> 00:20:53,480

experiments that are suggested for this

514  
00:20:51,440 --> 00:20:54,650  
and I love any of any of you who would

515  
00:20:53,480 --> 00:20:59,450  
like to review it I'd love to give you a

516  
00:20:54,650 --> 00:21:04,759  
copy thanks guy your idea of the

517  
00:20:59,450 --> 00:21:09,500  
timelessness of light supports my idea

518  
00:21:04,759 --> 00:21:13,879  
of the symmetry of causality and retro

519  
00:21:09,500 --> 00:21:16,910  
causality and also Richard Shoup

520  
00:21:13,880 --> 00:21:20,860  
statement that causality has no real

521  
00:21:16,910 --> 00:21:24,050  
meaning because what you have described

522  
00:21:20,859 --> 00:21:29,719  
cause and effect are coexistent and

523  
00:21:24,049 --> 00:21:33,319  
don't need to be separated I think

524  
00:21:29,720 --> 00:21:35,960  
that's the point of so cause and effect

525  
00:21:33,319 --> 00:21:40,279  
become very problematic or interesting I

526  
00:21:35,960 --> 00:21:43,430  
might say if events that come you know

527  
00:21:40,279 --> 00:21:47,299  
if to light these events are not

528  
00:21:43,430 --> 00:21:49,700  
separate or distinct a B and C but to me

529  
00:21:47,299 --> 00:21:52,220  
as an inertial observer they are

530  
00:21:49,700 --> 00:21:54,319  
distinct causality is obviously true for

531  
00:21:52,220 --> 00:21:58,370  
me but how does that work with something

532  
00:21:54,319 --> 00:22:00,859  
that's that's timeless and has all

533  
00:21:58,369 --> 00:22:02,479  
possible events sort of it's connected

534  
00:22:00,859 --> 00:22:05,509  
to all those possible events at the same

535  
00:22:02,480 --> 00:22:06,740  
time I think it leads to conclusions I

536  
00:22:05,509 --> 00:22:09,440  
think you can draw conclusions but it

537  
00:22:06,740 --> 00:22:10,759  
takes a lot of deep thinking and it

538  
00:22:09,440 --> 00:22:13,700  
doesn't again I'm not saying that

539  
00:22:10,759 --> 00:22:14,650  
there's there's no causality for us for

540  
00:22:13,700 --> 00:22:16,690  
a human observer

541  
00:22:14,650 --> 00:22:17,740  
we already know what the world does the

542

00:22:16,690 --> 00:22:19,090  
experiments are there and we're

543  
00:22:17,740 --> 00:22:21,099  
following those this is saying that

544  
00:22:19,089 --> 00:22:22,659  
there's some implications when you

545  
00:22:21,099 --> 00:22:27,189  
consider the lightest timeless but it's

546  
00:22:22,660 --> 00:22:29,290  
a great it's a great point no sky as you

547  
00:22:27,190 --> 00:22:33,340  
know we've talked about this admit from

548  
00:22:29,289 --> 00:22:37,210  
merely from your last presentation last

549  
00:22:33,339 --> 00:22:40,659  
weekend and I'm wondering what you've

550  
00:22:37,210 --> 00:22:42,549  
thought about the possibility that that

551  
00:22:40,660 --> 00:22:45,970  
which is spaceless and timeless a

552  
00:22:42,549 --> 00:22:50,470  
primordial non-existent void would

553  
00:22:45,970 --> 00:22:52,329  
intersect dynamically with space time

554  
00:22:50,470 --> 00:22:55,650  
energy and matter mind and body however

555  
00:22:52,329 --> 00:22:58,470  
quantum mechanically classically and be

556  
00:22:55,650 --> 00:23:03,120

simultaneous in time and space as

557

00:22:58,470 --> 00:23:06,360  
evidenced by light as a timeless

558

00:23:03,119 --> 00:23:09,729  
possibly an arc discharge of some kind

559

00:23:06,359 --> 00:23:14,049  
interacting between the void and

560

00:23:09,730 --> 00:23:16,599  
space-time well the reason I love

561

00:23:14,049 --> 00:23:18,700  
studying this is because it's in my view

562

00:23:16,599 --> 00:23:24,609  
profound and interesting and hard to

563

00:23:18,700 --> 00:23:28,299  
form conclusions I would I'd have to

564

00:23:24,609 --> 00:23:32,559  
think about that some more and I think

565

00:23:28,299 --> 00:23:34,509  
that the idea of a void is very

566

00:23:32,559 --> 00:23:35,679  
consistent with the idea of timelessness

567

00:23:34,509 --> 00:23:37,690  
they're both things that we cannot

568

00:23:35,680 --> 00:23:41,110  
possibly describe with our current

569

00:23:37,690 --> 00:23:43,809  
language and models and so quite

570

00:23:41,109 --> 00:23:47,819  
possibly similar met descriptions of

571  
00:23:43,809 --> 00:23:47,819  
systems yeah thanks

572  
00:23:49,440 --> 00:23:59,680  
in the observations of photons arriving

573  
00:23:56,380 --> 00:24:02,620  
on earth that originated at the

574  
00:23:59,680 --> 00:24:06,370  
beginning of the universe it says that

575  
00:24:02,619 --> 00:24:08,500  
as we observe those photons we're not

576  
00:24:06,369 --> 00:24:11,769  
really looking at something that

577  
00:24:08,500 --> 00:24:14,339  
occurred in the past but since the

578  
00:24:11,769 --> 00:24:17,920  
photons are timeless we are literally

579  
00:24:14,339 --> 00:24:20,459  
looking at those events at the moment

580  
00:24:17,920 --> 00:24:20,460  
they happened

581  
00:24:20,920 --> 00:24:29,450  
well disregarding and anything I've said

582  
00:24:24,740 --> 00:24:31,880  
if blue light is emitted but if a

583  
00:24:29,450 --> 00:24:35,240  
pattern of blue and green lights say is

584  
00:24:31,880 --> 00:24:37,550  
emitted from a star 100,000 years ago

585  
00:24:35,240 --> 00:24:39,380  
that's 100,000 light years away and we

586  
00:24:37,549 --> 00:24:42,559  
see it and we see that pattern we're

587  
00:24:39,380 --> 00:24:45,080  
seeing light as it was emitted I mean

588  
00:24:42,559 --> 00:24:46,609  
that we're seeing the event now but

589  
00:24:45,079 --> 00:24:48,769  
we're making the assumption that it

590  
00:24:46,609 --> 00:24:50,240  
happened a long time ago which I don't

591  
00:24:48,769 --> 00:24:52,400  
want to really call an assumption I

592  
00:24:50,240 --> 00:24:55,120  
think the point that you're getting at

593  
00:24:52,400 --> 00:24:58,250  
is that light if it's it's absolutely

594  
00:24:55,119 --> 00:25:01,099  
rigorously true I think that light

595  
00:24:58,250 --> 00:25:03,019  
because you can't consider it to have

596  
00:25:01,099 --> 00:25:05,899  
taken any particular time to get there

597  
00:25:03,019 --> 00:25:09,049  
because light has dilated completely I

598  
00:25:05,900 --> 00:25:12,620  
mean the process time is zero it does in

599

00:25:09,049 --> 00:25:14,059  
some sense instantaneously connect the

600  
00:25:12,619 --> 00:25:16,069  
distance star and the observation of

601  
00:25:14,059 --> 00:25:17,240  
that distance star but it takes a long

602  
00:25:16,069 --> 00:25:18,589  
time from a earthbound observers

603  
00:25:17,240 --> 00:25:20,690  
reference frame for the light to make

604  
00:25:18,589 --> 00:25:22,220  
that distance and and in there is the

605  
00:25:20,690 --> 00:25:24,650  
dynamics that we're trying to uncover

606  
00:25:22,220 --> 00:25:26,900  
here thank you thank you very much sky

607  
00:25:24,650 --> 00:25:28,580  
we're running at least 20 minutes late

608  
00:25:26,900 --> 00:25:29,900  
so I'm going to kind of cut off the

609  
00:25:28,579 --> 00:25:32,689  
questions and I'll turn the mic over to

610  
00:25:29,900 --> 00:25:34,800  
Roger for 30 seconds

611  
00:25:32,690 --> 00:25:40,499  
[Applause]

612  
00:25:34,799 --> 00:25:40,499  
[Music]

613  
00:25:40,669 --> 00:25:42,730

you

614

00:25:50,220 --> 00:25:52,279

you