



1
00:00:25,150 --> 00:00:16,080

[Music]

2
00:00:27,069 --> 00:00:25,160

thank you very much it's an honor to be

3
00:00:28,359 --> 00:00:27,079

here and so many great presentations

4
00:00:33,400 --> 00:00:28,369

this morning I'm really pleased to be

5
00:00:37,090 --> 00:00:33,410

part of this and in response to the last

6
00:00:39,760 --> 00:00:37,100

gentleman Brennen what I'll be talking

7
00:00:41,650 --> 00:00:39,770

about today would would affect the

8
00:00:43,440 --> 00:00:41,660

interpretation I would want to make for

9
00:00:48,430 --> 00:00:43,450

those pseudo re G's rather than

10
00:00:50,380 --> 00:00:48,440

precognition of what the possible states

11
00:00:52,569 --> 00:00:50,390

of the art of the pseudo re G could be I

12
00:00:54,760 --> 00:00:52,579

wouldn't want to suggest the way I look

13
00:00:56,620 --> 00:00:54,770

at it would be a retroactive I'm gonna

14

00:00:57,819 --> 00:00:56,630
suggest that the collapse of that

15

00:01:00,069 --> 00:00:57,829
particular system into that particular

16

00:01:02,650 --> 00:01:00,079
state at that time is a relational

17

00:01:06,310 --> 00:01:02,660
process relative to you the experimenter

18

00:01:09,219 --> 00:01:06,320
and so therefore it could be a process

19

00:01:11,859 --> 00:01:09,229
of retro actively affecting the actual

20

00:01:14,770 --> 00:01:11,869
time of the initiation of that pseudo re

21

00:01:16,270 --> 00:01:14,780
G rather than Precog recognizing what

22

00:01:18,669 --> 00:01:16,280
it's going to be and then choosing that

23

00:01:19,749 --> 00:01:18,679
time in the present so and I think you

24

00:01:22,149 --> 00:01:19,759
could distinguish between those by

25

00:01:25,629 --> 00:01:22,159
running a experiment may be modeled

26

00:01:27,910 --> 00:01:25,639

after Helmut Smith's work because the

27

00:01:29,499 --> 00:01:27,920

the data set is known in advance right

28

00:01:31,419 --> 00:01:29,509

because it's generated by a mathematical

29

00:01:33,219 --> 00:01:31,429

function at time zero the whole data set

30

00:01:35,529 --> 00:01:33,229

is known and can be analyzed in advance

31

00:01:36,519 --> 00:01:35,539

of the experiment being complete so

32

00:01:38,620 --> 00:01:36,529

anyway just some thoughts and I'd love

33

00:01:41,590 --> 00:01:38,630

to talk with you Brennan later thank you

34

00:01:43,870 --> 00:01:41,600

for the great presentation is the red

35

00:01:45,399 --> 00:01:43,880

button the light okay great so I'm going

36

00:01:46,419 --> 00:01:45,409

to talk about relational collapse how

37

00:01:47,559 --> 00:01:46,429

many of you know what collapse of the

38

00:01:49,779 --> 00:01:47,569

wavefunction is in quantum mechanics

39

00:01:52,629 --> 00:01:49,789

that concept okay how many of you know

40

00:01:54,550 --> 00:01:52,639

what relational collapse is relational

41

00:01:56,589 --> 00:01:54,560

collapse is the opposite of objective

42

00:02:00,209 --> 00:01:56,599

collapse objective collapse is the idea

43

00:02:02,800 --> 00:02:00,219

that a quantum mechanical system given a

44

00:02:05,889 --> 00:02:02,810

plethora of multiple possible states

45

00:02:07,269 --> 00:02:05,899

would take an objective single state as

46

00:02:09,580 --> 00:02:07,279

a result of a measurement by an

47

00:02:11,610 --> 00:02:09,590

individual and that objective state has

48

00:02:14,080 --> 00:02:11,620

some kind of ontological status of being

49

00:02:16,750 --> 00:02:14,090

actually real for everybody everywhere

50

00:02:18,100 --> 00:02:16,760

at that moment rather than relational

51
00:02:20,559 --> 00:02:18,110
collapse which means relative to the

52
00:02:23,830 --> 00:02:20,569
observer so if you're familiar with

53
00:02:25,360 --> 00:02:23,840
friend concept that if if Daniel makes

54
00:02:28,449 --> 00:02:25,370
it experimental measurement in the lab

55
00:02:30,190 --> 00:02:28,459
and I'm outside of the lab when I enter

56
00:02:31,929 --> 00:02:30,200
the lab or the relational model would

57
00:02:33,399 --> 00:02:31,939
say that both Daniel and the

58
00:02:35,050 --> 00:02:33,409
experimental results are in a

59
00:02:37,119 --> 00:02:35,060
superposition position state together

60
00:02:40,690 --> 00:02:37,129
that they're correlated but the actual

61
00:02:42,459 --> 00:02:40,700
reality of that result is not actually

62
00:02:44,410 --> 00:02:42,469
determined for me as the outside

63
00:02:47,649 --> 00:02:44,420

observer and that is the relational

64

00:02:49,750 --> 00:02:47,659

model okay so I'm gonna use special

65

00:02:52,390 --> 00:02:49,760

relativity today to try and demonstrate

66

00:02:54,190 --> 00:02:52,400

to you that the relational model is the

67

00:02:57,520 --> 00:02:54,200

only viable interpretation of quantum

68

00:03:00,449 --> 00:02:57,530

mechanics that matches with special

69

00:03:02,949 --> 00:03:00,459

relativity which is a pretty stringent

70

00:03:07,869 --> 00:03:02,959

criteria because we know the special

71

00:03:09,220 --> 00:03:07,879

relativity is correct so it's gonna it's

72

00:03:10,569 --> 00:03:09,230

going to weed out about half of the

73

00:03:12,099 --> 00:03:10,579

interpretations of quantum mechanics

74

00:03:13,720 --> 00:03:12,109

which is something that we have not been

75

00:03:15,009 --> 00:03:13,730

able to do yet currently all

76

00:03:18,220 --> 00:03:15,019

interpretations of quantum mechanics are

77

00:03:19,449 --> 00:03:18,230

equally relevant so hopefully we'll be

78

00:03:20,740 --> 00:03:19,459

able to I'll be able to demonstrate to

79

00:03:23,080 --> 00:03:20,750

you in a convincing way that that is the

80

00:03:25,210 --> 00:03:23,090

case so the overview is at special

81

00:03:27,249 --> 00:03:25,220

relativity from 1905 leads to the

82

00:03:28,800 --> 00:03:27,259

conclusion any definite reality must be

83

00:03:32,050 --> 00:03:28,810

described relative to another observer

84

00:03:33,879 --> 00:03:32,060

this is called relationality and the

85

00:03:37,360 --> 00:03:33,889

conclusion at least my version of

86

00:03:42,149 --> 00:03:37,370

relationality is that physical reality

87

00:03:44,289 --> 00:03:42,159

is secondary in consciousness is primary

88

00:03:46,479 --> 00:03:44,299

I'm not the first one to talk about this

89

00:03:48,429 --> 00:03:46,489

this is quite a bit of literature and

90

00:03:50,439 --> 00:03:48,439

ideas out there on this topic I'm gonna

91

00:03:53,499 --> 00:03:50,449

try and show it rigorously that this has

92

00:03:55,689 --> 00:03:53,509

to be the case so I'll start with the

93

00:03:57,099 --> 00:03:55,699

derivation so many of the great advances

94

00:03:58,749 --> 00:03:57,109

in physics have been a result of people

95

00:04:01,330 --> 00:03:58,759

studying light and all of these people

96

00:04:03,399 --> 00:04:01,340

has studied light as a major part of

97

00:04:07,089 --> 00:04:03,409

their careers so we've got iron stein

98

00:04:10,539 --> 00:04:07,099

Max Planck Newton Thomas Young Maxwell

99

00:04:11,740 --> 00:04:10,549

and Huygens and we still don't know what

100

00:04:14,289 --> 00:04:11,750

light is and that's the beauty of it

101
00:04:17,229 --> 00:04:14,299
it's it's this central piece of physics

102
00:04:18,819 --> 00:04:17,239
that is is still not understood we've

103
00:04:20,529 --> 00:04:18,829
got lots of models and all these models

104
00:04:22,659 --> 00:04:20,539
work very well for specific experiences

105
00:04:24,700 --> 00:04:22,669
but there's others stuff about light it

106
00:04:27,580 --> 00:04:24,710
isn't not understood so let's talk about

107
00:04:31,240 --> 00:04:27,590
the Lorentz transformation for a simple

108
00:04:32,350 --> 00:04:31,250
non light example for muons these are

109
00:04:34,029 --> 00:04:32,360
particles that are generated in the

110
00:04:34,480 --> 00:04:34,039
upper atmosphere I'm going to try and

111
00:04:36,219 --> 00:04:34,490
use them

112
00:04:37,930 --> 00:04:36,229
to explain to you how special relativity

113
00:04:40,180 --> 00:04:37,940

works for those of you who might not be

114

00:04:42,100 --> 00:04:40,190

as familiar and the main result we're

115

00:04:43,089 --> 00:04:42,110

going to talk about is time dilation how

116

00:04:45,580 --> 00:04:43,099

many are familiar with the idea that

117

00:04:47,080 --> 00:04:45,590

time is dilated for objects in reference

118

00:04:50,379 --> 00:04:47,090

frames that are moving close to the

119

00:04:53,200 --> 00:04:50,389

speed of light okay relative to me the

120

00:04:55,779 --> 00:04:53,210

observer so for a muon that's generated

121

00:04:58,240 --> 00:04:55,789

in the upper atmosphere by cosmic

122

00:05:00,420 --> 00:04:58,250

processes a muon has a very short

123

00:05:02,589 --> 00:05:00,430

half-life of about two microseconds so

124

00:05:03,909 --> 00:05:02,599

mu1 is going to decay very quickly

125

00:05:06,370 --> 00:05:03,919

according to natural spontaneous

126

00:05:07,629 --> 00:05:06,380

physical processes that we don't I don't

127

00:05:09,670 --> 00:05:07,639

think we fully understand or actually

128

00:05:11,499 --> 00:05:09,680

probably do but I'm not a particle

129

00:05:12,969 --> 00:05:11,509

physicist so I don't understand them but

130

00:05:14,920 --> 00:05:12,979

I know that after about two microseconds

131

00:05:21,939 --> 00:05:14,930

they decay and so it would look

132

00:05:23,379 --> 00:05:21,949

something like this okay so what in my

133

00:05:26,279 --> 00:05:23,389

model I mean this is just a metaphor

134

00:05:29,290 --> 00:05:26,289

it's vibrating Wow mwah mwah mwah and

135

00:05:33,909 --> 00:05:29,300

explodes right that's my model for the

136

00:05:35,290 --> 00:05:33,919

decay of the muon and what I'm trying to

137

00:05:36,999 --> 00:05:35,300

demonstrate here is that it has a

138

00:05:39,159 --> 00:05:37,009

certain process time there's a certain

139

00:05:42,580 --> 00:05:39,169

physical process that's governing this

140

00:05:44,379 --> 00:05:42,590

behavior and so what you would expect

141

00:05:45,999 --> 00:05:44,389

for a muon even if it's traveling fast

142

00:05:47,920 --> 00:05:46,009

from the upper atmosphere it's only two

143

00:05:50,800 --> 00:05:47,930

microseconds so it doesn't get very far

144

00:05:51,999 --> 00:05:50,810

and so this is what you expect it

145

00:05:55,740 --> 00:05:52,009

wouldn't get very far wouldn't make it

146

00:05:59,529 --> 00:05:55,750

to the surface of the earth and again

147

00:06:03,309 --> 00:05:59,539

one WOM WOM WOM okay but what actually

148

00:06:07,589 --> 00:06:03,319

happens is different because time is

149

00:06:16,659 --> 00:06:07,599

dilated for the process time of the muon

150

00:06:19,180 --> 00:06:16,669

it looks like this Wow okay so what the

151
00:06:20,589 --> 00:06:19,190
process time is dilated is actually

152
00:06:21,959 --> 00:06:20,599
slowed down from the reference frame of

153
00:06:24,430 --> 00:06:21,969
me sitting on the earth

154
00:06:25,899 --> 00:06:24,440
this is a basic result from special

155
00:06:28,330 --> 00:06:25,909
relativity that was confirmed in the 60s

156
00:06:29,589 --> 00:06:28,340
and we observed many of these muons of

157
00:06:31,390 --> 00:06:29,599
the surface of the earth which indicates

158
00:06:33,540 --> 00:06:31,400
that yes indeed time is dilated for

159
00:06:36,730 --> 00:06:33,550
these muons now what's important here in

160
00:06:39,580 --> 00:06:36,740
this illustration is that I am talking

161
00:06:42,550 --> 00:06:39,590
about me as the observer on the surface

162
00:06:44,019 --> 00:06:42,560
of the earth I didn't put a clock in the

163
00:06:46,750 --> 00:06:44,029

reference frame of the muon I didn't

164

00:06:47,830 --> 00:06:46,760

talk about the the time as experienced

165

00:06:49,750 --> 00:06:47,840

by the muon

166

00:06:52,120 --> 00:06:49,760

or the time relative to the reference

167

00:06:56,040 --> 00:06:52,130

frame of the muon what I'm discussing is

168

00:06:59,909 --> 00:06:56,050

the time that I measure sitting on earth

169

00:07:02,140 --> 00:06:59,919

and what I'm measuring are two things an

170

00:07:04,060 --> 00:07:02,150

earth observer can measure two different

171

00:07:05,830 --> 00:07:04,070

time quantities the first one is the

172

00:07:07,900 --> 00:07:05,840

amount of time it appears it actually

173

00:07:09,129 --> 00:07:07,910

takes the muon to travel from the upper

174

00:07:12,280 --> 00:07:09,139

atmosphere to the lower atmosphere

175

00:07:14,439 --> 00:07:12,290

that's from point A to point B and I

176

00:07:15,879 --> 00:07:14,449

measure that I might stopwatch and I

177

00:07:19,150 --> 00:07:15,889

write down the time that it takes might

178

00:07:20,530 --> 00:07:19,160

take a second for that to happen that's

179

00:07:23,140 --> 00:07:20,540

the time for me want to get from A to B

180

00:07:25,060 --> 00:07:23,150

the second thing I can measure however

181

00:07:29,530 --> 00:07:25,070

is the process time for the decay of the

182

00:07:32,500 --> 00:07:29,540

muon and as we noted the process time

183

00:07:34,480 --> 00:07:32,510

for the decay of the muon it's obvious

184

00:07:36,310 --> 00:07:34,490

to us that it was dilated because we

185

00:07:38,590 --> 00:07:36,320

know from other experiments that it

186

00:07:40,270 --> 00:07:38,600

takes two microseconds to decay and in

187

00:07:41,590 --> 00:07:40,280

this example in this experience it

188

00:07:45,070 --> 00:07:41,600

lasted for much longer than that

189

00:07:48,120 --> 00:07:45,080

and so we we can infer that the process

190

00:07:50,890 --> 00:07:48,130

time of the muon has been dilated the

191

00:07:53,170 --> 00:07:50,900

key point is that I am a earthbound

192

00:07:55,210 --> 00:07:53,180

observer an inertial reference frame

193

00:07:56,770 --> 00:07:55,220

making a measurement of this muon it

194

00:07:58,570 --> 00:07:56,780

never once did I try and put myself in

195

00:08:00,700 --> 00:07:58,580

the reference frame of the muon which is

196

00:08:01,990 --> 00:08:00,710

what we typically try to do in in you

197

00:08:05,440 --> 00:08:02,000

know discussing relativity with the

198

00:08:07,089 --> 00:08:05,450

yardsticks and and stopwatches in this

199

00:08:08,320 --> 00:08:07,099

case it's good though smaadhahl z' of

200

00:08:09,520 --> 00:08:08,330

large sticks and stop watches are gonna

201
00:08:11,260 --> 00:08:09,530
get in our way because all I'm really

202
00:08:12,790 --> 00:08:11,270
doing is an Earthbound observer making a

203
00:08:16,930 --> 00:08:12,800
measurement of these two time quantities

204
00:08:18,610 --> 00:08:16,940
relevant to the new one so for a given

205
00:08:20,050 --> 00:08:18,620
time measured by me less and less time

206
00:08:20,379 --> 00:08:20,060
passes for the muon from my point of

207
00:08:24,730 --> 00:08:20,389
view

208
00:08:28,150 --> 00:08:24,740
now here's my real point what I'm about

209
00:08:30,640 --> 00:08:28,160
to say for half of the physicists I talk

210
00:08:32,019 --> 00:08:30,650
to you about this they'll they'll say

211
00:08:35,260 --> 00:08:32,029
you know skip that whole part of your

212
00:08:36,820 --> 00:08:35,270
talk it's obvious that was what one

213
00:08:39,670 --> 00:08:36,830

physicist said to me at the end of the

214

00:08:43,060 --> 00:08:39,680

talk at the conference down in San Diego

215

00:08:44,079 --> 00:08:43,070

and then the other half will say I don't

216

00:08:45,240 --> 00:08:44,089

agree with that that doesn't make any

217

00:08:48,040 --> 00:08:45,250

sense it's meaningless

218

00:08:51,370 --> 00:08:48,050

so I've decided that before moving on I

219

00:08:53,290 --> 00:08:51,380

need to spend time figuring out how did

220

00:08:55,990 --> 00:08:53,300

how to present this in a way that is

221

00:08:58,030 --> 00:08:56,000

convincing and makes sense to people so

222

00:09:00,040 --> 00:08:58,040

the point is that I can replace the muon

223

00:09:01,519 --> 00:09:00,050

with a light particle now what we're

224

00:09:03,769 --> 00:09:01,529

talking about is just a system

225

00:09:06,439 --> 00:09:03,779

it's moving at a given speed relative to

226

00:09:07,759 --> 00:09:06,449

me the relative speed of the two systems

227

00:09:09,650 --> 00:09:07,769

that's what Einstein talks about in his

228

00:09:10,610 --> 00:09:09,660

initial paper in 1905 is the relative

229

00:09:13,100 --> 00:09:10,620

speed of the two systems

230

00:09:14,869 --> 00:09:13,110

he doesn't say inertial at all in that

231

00:09:16,519 --> 00:09:14,879

paper he doesn't talk about the

232

00:09:19,280 --> 00:09:16,529

reference frame and he says talks about

233

00:09:21,679 --> 00:09:19,290

reference to him I think one time and he

234

00:09:25,100 --> 00:09:21,689

talks about the the relative speed of

235

00:09:26,239 --> 00:09:25,110

the two systems and so it doesn't appear

236

00:09:27,679 --> 00:09:26,249

to me that there's any problem with

237

00:09:29,749 --> 00:09:27,689

talking about light it's simply an

238

00:09:31,369 --> 00:09:29,759

entity that's moving past me at a

239

00:09:33,939 --> 00:09:31,379

certain speed and that speed happens to

240

00:09:36,170 --> 00:09:33,949

be C the speed of light but I'm not

241

00:09:37,850 --> 00:09:36,180

putting myself in the quote unquote

242

00:09:40,850 --> 00:09:37,860

reference frame of the Photon you can't

243

00:09:43,249 --> 00:09:40,860

do that what I'm doing is measuring on

244

00:09:44,900 --> 00:09:43,259

earth from an Earthbound position the

245

00:09:48,920 --> 00:09:44,910

properties of this entity that's moving

246

00:09:50,480 --> 00:09:48,930

past me so what we obtain very obviously

247

00:09:52,129 --> 00:09:50,490

from the equations of the Lorentz

248

00:09:54,319 --> 00:09:52,139

transformation is that the process time

249

00:10:00,530 --> 00:09:54,329

where the time of evolution of the light

250

00:10:01,759 --> 00:10:00,540

is equal to zero so if I'm able to

251
00:10:04,519 --> 00:10:01,769
convince you of that

252
00:10:07,759 --> 00:10:04,529
then the in the implications of that are

253
00:10:11,360 --> 00:10:07,769
very very interesting and we'll try and

254
00:10:16,639 --> 00:10:11,370
get there so the implication to me is

255
00:10:21,920 --> 00:10:16,649
something like this light is timeless we

256
00:10:23,389 --> 00:10:21,930
might also say time is meaningless when

257
00:10:25,129 --> 00:10:23,399
we were discussing the process time of

258
00:10:26,869 --> 00:10:25,139
light it's hard to talk about something

259
00:10:28,610 --> 00:10:26,879
as meaningless or it's hard to talk

260
00:10:30,710 --> 00:10:28,620
about timelessness from the perspective

261
00:10:33,290 --> 00:10:30,720
of you and I who are in space and time

262
00:10:36,049 --> 00:10:33,300
and that's how we do our physics and

263
00:10:38,720 --> 00:10:36,059

that's why this is so hard to talk about

264

00:10:40,549 --> 00:10:38,730

in physics but yet I believe that we can

265

00:10:42,259 --> 00:10:40,559

show that it's an important conversation

266

00:10:45,799 --> 00:10:42,269

to have and that there are implications

267

00:10:47,419 --> 00:10:45,809

that can be measured so possible

268

00:10:50,569 --> 00:10:47,429

objections are light does not have a

269

00:10:53,660 --> 00:10:50,579

perspective that's true light is not an

270

00:10:54,860 --> 00:10:53,670

inertial reference frame that's true no

271

00:10:57,590 --> 00:10:54,870

clocks can move at light speed

272

00:11:01,759 --> 00:10:57,600

that's true and light cannot experience

273

00:11:04,790 --> 00:11:01,769

time that's true but I didn't say any of

274

00:11:06,199 --> 00:11:04,800

those things okay and that's what I'm

275

00:11:08,780 --> 00:11:06,209

trying to get across I'm working with a

276

00:11:11,059 --> 00:11:08,790

physicist right now just talking weakly

277

00:11:12,440 --> 00:11:11,069

and he's making sure I don't use words

278

00:11:15,200 --> 00:11:12,450

that point to

279

00:11:17,450 --> 00:11:15,210

any of these things I'm not saying what

280

00:11:19,280 --> 00:11:17,460

does light measure as its timeframe or

281

00:11:21,140 --> 00:11:19,290

what is the experience of light though

282

00:11:22,640 --> 00:11:21,150

what is how does light pass for time

283

00:11:24,680 --> 00:11:22,650

none of those things make sense to talk

284

00:11:26,630 --> 00:11:24,690

about what I'm saying is trying to

285

00:11:29,330 --> 00:11:26,640

define the process time for light that

286

00:11:34,210 --> 00:11:29,340

that governs how it evolves and saying

287

00:11:36,890 --> 00:11:34,220

that that value must be zero and so

288

00:11:42,230 --> 00:11:36,900

light cannot evolve from point A to

289

00:11:45,170 --> 00:11:42,240

point B it simply cannot so the lumens

290

00:11:47,510 --> 00:11:45,180

Lorentz transformation says for me an

291

00:11:49,310 --> 00:11:47,520

Earthbound observer the light definitely

292

00:11:51,890 --> 00:11:49,320

changes it goes from point A in the

293

00:11:54,500 --> 00:11:51,900

light bulb to point B on the clock on

294

00:11:56,090 --> 00:11:54,510

the wall to point C on my eyes those are

295

00:11:59,450 --> 00:11:56,100

three events that are separate in space

296

00:12:01,400 --> 00:11:59,460

and time for me the observer but to talk

297

00:12:04,550 --> 00:12:01,410

about that as those being separate

298

00:12:05,350 --> 00:12:04,560

events for the actual light doesn't make

299

00:12:07,490 --> 00:12:05,360

any sense

300

00:12:10,750 --> 00:12:07,500

because light cannot evolve from point A

301
00:12:13,490 --> 00:12:10,760
to point B a very quick technical point

302
00:12:17,000 --> 00:12:13,500
these are what I would call origins

303
00:12:19,100 --> 00:12:17,010
centered events what light leaving the

304
00:12:21,080 --> 00:12:19,110
light bulb traveling to the clock and

305
00:12:25,430 --> 00:12:21,090
hitting the eyeball call them a B and C

306
00:12:26,780 --> 00:12:25,440
they all happen right where the right

307
00:12:34,580 --> 00:12:26,790
where the bulb it right where the light

308
00:12:36,770 --> 00:12:34,590
is you sure this video so a B C and for

309
00:12:39,470 --> 00:12:36,780
events like that the distance between

310
00:12:41,930 --> 00:12:39,480
the events divided by the time taken

311
00:12:44,060 --> 00:12:41,940
between the events happens to be a

312
00:12:46,780 --> 00:12:44,070
special case where it's equal to the

313
00:12:48,800 --> 00:12:46,790

relative speed of the two systems

314

00:12:49,970 --> 00:12:48,810

because those events are happening when

315

00:12:53,210 --> 00:12:49,980

the light actually arrives at those

316

00:12:54,560 --> 00:12:53,220

points so this is a technical piece that

317

00:12:56,270 --> 00:12:54,570

allows us to make a modification to

318

00:12:59,240 --> 00:12:56,280

Lorentz transformation here's the

319

00:13:03,170 --> 00:12:59,250

Lorentz transformation where T is the

320

00:13:05,480 --> 00:13:03,180

time measured by me for the light to

321

00:13:06,950 --> 00:13:05,490

move from point A to point B L is the

322

00:13:08,980 --> 00:13:06,960

distance L measure for the light to go

323

00:13:12,830 --> 00:13:08,990

to point eight a point A to point B and

324

00:13:13,640 --> 00:13:12,840

T prime is the time the process time of

325

00:13:15,020 --> 00:13:13,650

the light this is what we're talking

326

00:13:17,660 --> 00:13:15,030

about is the process time of the light

327

00:13:21,140 --> 00:13:17,670

and V is the relative speed of the two

328

00:13:24,110 --> 00:13:21,150

systems when we plug in V equals L over

329

00:13:25,650 --> 00:13:24,120

T this actually changes the equation

330

00:13:29,910 --> 00:13:25,660

from being one which becomes

331

00:13:31,230 --> 00:13:29,920

infinite to one which becomes zero if

332

00:13:34,200 --> 00:13:31,240

this if it was infinite it would be

333

00:13:36,090 --> 00:13:34,210

undefined and meaningless in physics but

334

00:13:37,350 --> 00:13:36,100

in this case instead of γ on the

335

00:13:38,670 --> 00:13:37,360

left hand side you see γ there that

336

00:13:41,520 --> 00:13:38,680

usually blows up to infinity when you

337

00:13:46,320 --> 00:13:41,530

get to Lightspeed it actually cancels

338

00:13:49,080 --> 00:13:46,330

out with the term on top and you get

339

00:13:50,910 --> 00:13:49,090

essentially T over γ or T capital T

340

00:13:52,350 --> 00:13:50,920

times $1 - v^2/c^2$ over c^2

341

00:13:54,150 --> 00:13:52,360

and the reason I put this here is

342

00:13:56,280 --> 00:13:54,160

because it simply indicates that

343

00:13:58,350 --> 00:13:56,290

when you plug in $v = c$ at this

344

00:14:00,240 --> 00:13:58,360

point you get a very nice easy result

345

00:14:02,490 --> 00:14:00,250

rather than anything that blows up to

346

00:14:05,150 --> 00:14:02,500

infinity and so you get that the process

347

00:14:06,990 --> 00:14:05,160

time for the light equals to zero

348

00:14:10,860 --> 00:14:07,000

interpreting that as another matter and

349

00:14:12,480 --> 00:14:10,870

and very challenging so I've said light

350

00:14:16,280 --> 00:14:12,490

as timeless and light cannot evolve from

351
00:14:19,110 --> 00:14:16,290
point A to point B and just a brief note

352
00:14:20,580 --> 00:14:19,120
Einstein said that you know you could

353
00:14:22,500 --> 00:14:20,590
object that you can't plug $V = c$

354
00:14:24,420 --> 00:14:22,510
into the Lorentz transform you can't do

355
00:14:26,040 --> 00:14:24,430
that for an object that has mass any

356
00:14:28,140 --> 00:14:26,050
kind of mass but we're talking about

357
00:14:30,330 --> 00:14:28,150
light here specifically and only light

358
00:14:32,820 --> 00:14:30,340
which has no rest mass and in Einstein's

359
00:14:34,500 --> 00:14:32,830
original paper he said for $V = c$

360
00:14:36,810 --> 00:14:34,510
all moving objects viewed from the

361
00:14:39,060 --> 00:14:36,820
stationary system shrivel up into plane

362
00:14:40,620 --> 00:14:39,070
figures which is essentially what we're

363
00:14:42,300 --> 00:14:40,630

talking about here for values greater

364

00:14:44,520 --> 00:14:42,310

than that of light our deliberations

365

00:14:46,200 --> 00:14:44,530

become meaningless it doesn't say that

366

00:14:48,420 --> 00:14:46,210

for the value of Lightspeed our

367

00:14:50,370 --> 00:14:48,430

deliberations are meaningless I think he

368

00:14:53,340 --> 00:14:50,380

would agree that it indicates that our

369

00:14:54,960 --> 00:14:53,350

deliberations become complicated but not

370

00:14:57,930 --> 00:14:54,970

meaningless and we have to understand

371

00:15:00,570 --> 00:14:57,940

that use case they shrivel up into plane

372

00:15:03,230 --> 00:15:00,580

figures what did that mean to him what

373

00:15:08,160 --> 00:15:05,760

so is it valid to ask how would light

374

00:15:09,360 --> 00:15:08,170

registers events we interact with light

375

00:15:11,700 --> 00:15:09,370

and make various distinguishable

376

00:15:13,170 --> 00:15:11,710

measurements that affect it light is an

377

00:15:15,780 --> 00:15:13,180

entity that gets changed by our

378

00:15:17,190 --> 00:15:15,790

measurements so I do think it's a valid

379

00:15:19,590 --> 00:15:17,200

to ask how light registers our

380

00:15:22,260 --> 00:15:19,600

interactions with it and I don't have to

381

00:15:23,880 --> 00:15:22,270

say experiences our actions or anything

382

00:15:26,190 --> 00:15:23,890

like that I'm saying registers is a very

383

00:15:29,730 --> 00:15:26,200

sort of physical word that doesn't have

384

00:15:31,740 --> 00:15:29,740

to do with anthropomorphism so what is

385

00:15:33,540 --> 00:15:31,750

timelessness how can light be timeless

386

00:15:34,980 --> 00:15:33,550

when we see it moving all the time we

387

00:15:38,220 --> 00:15:34,990

can measure light moving from point A to

388

00:15:41,250 --> 00:15:38,230

point B very precisely how

389

00:15:42,600 --> 00:15:41,260

can it be timeless well the conclusion I

390

00:15:45,270 --> 00:15:42,610

draw from this is that light does not

391

00:15:47,550 --> 00:15:45,280

actually move the Lorentz

392

00:15:50,550 --> 00:15:47,560

transformations say that space and time

393

00:15:52,490 --> 00:15:50,560

both become essentially zero whatever

394

00:15:54,810 --> 00:15:52,500

that means

395

00:15:57,410 --> 00:15:54,820

so light can't move it has nowhere to go

396

00:15:59,460 --> 00:15:57,420

it doesn't make any sense it's undefined

397

00:16:02,360 --> 00:15:59,470

the conclusion I draw is that light

398

00:16:05,880 --> 00:16:02,370

appears to have moved when its measured

399

00:16:09,920 --> 00:16:05,890

life always appears to move a distance L

400

00:16:12,270 --> 00:16:09,930

in a time T given by the speed of light

401
00:16:13,830 --> 00:16:12,280
but only when you make a measurement you

402
00:16:17,220 --> 00:16:13,840
can't say anything about it other than

403
00:16:19,520 --> 00:16:17,230
that and so when I when I observe light

404
00:16:22,920 --> 00:16:19,530
after bouncing off a clock on the wall

405
00:16:24,420 --> 00:16:22,930
I'm observing it at a position and time

406
00:16:26,970 --> 00:16:24,430
as if it had traveled the intervening

407
00:16:28,860 --> 00:16:26,980
distance that doesn't mean it actually

408
00:16:31,110 --> 00:16:28,870
did travel the intervening distance in

409
00:16:34,620 --> 00:16:31,120
some kind of continuous way or absolute

410
00:16:36,900 --> 00:16:34,630
real way it means that it's measured to

411
00:16:39,930 --> 00:16:36,910
have done so when I actually make a

412
00:16:41,730 --> 00:16:39,940
measurement and if you see some

413
00:16:43,890 --> 00:16:41,740

similarities to quantum mechanics that's

414

00:16:45,510 --> 00:16:43,900

good because we actually arrived at this

415

00:16:47,910 --> 00:16:45,520

without invoking quantum mechanics at

416

00:16:49,260 --> 00:16:47,920

all the idea that the system doesn't

417

00:16:52,200 --> 00:16:49,270

have a definite state until a

418

00:16:54,180 --> 00:16:52,210

measurement is actually made is one of

419

00:16:55,440 --> 00:16:54,190

the central pieces of quantum mechanics

420

00:16:57,480 --> 00:16:55,450

but we are just talking about special

421

00:16:58,800 --> 00:16:57,490

relativity at this point and so it to me

422

00:16:59,970 --> 00:16:58,810

that there's it brings them together in

423

00:17:04,050 --> 00:16:59,980

a way it shows that they have a common

424

00:17:06,540 --> 00:17:04,060

origin or a common logic to them if you

425

00:17:07,950 --> 00:17:06,550

plug in the the T equals zero in there

426

00:17:09,900 --> 00:17:07,960

what you get is a very trivial result

427

00:17:12,090 --> 00:17:09,910

which is that the distance and the time

428

00:17:14,160 --> 00:17:12,100

actually traveled by the light relative

429

00:17:15,360 --> 00:17:14,170

to me is given by the speed of light so

430

00:17:19,860 --> 00:17:15,370

the light always appears to move at the

431

00:17:23,220 --> 00:17:19,870

speed of light so here's the the

432

00:17:26,640 --> 00:17:23,230

question I want to ask you if light is

433

00:17:32,130 --> 00:17:26,650

timeless then the now light already

434

00:17:34,490 --> 00:17:32,140

exists in tomorrow so just take a minute

435

00:17:36,780 --> 00:17:34,500

to picture yourself on a sunny field

436

00:17:38,550 --> 00:17:36,790

it's a beautiful sunny day and you're

437

00:17:44,430 --> 00:17:38,560

feeling the the warmth of the light on

438

00:17:47,320 --> 00:17:44,440

your skin and that light is timeless so

439

00:17:50,320 --> 00:17:47,330

that very same light

440

00:17:52,240 --> 00:17:50,330

is connected timelessly somehow to the

441

00:17:53,669 --> 00:17:52,250

two when it left the event of the light

442

00:17:55,990 --> 00:17:53,679

leaving the Sun eight minutes before

443

00:17:59,730 --> 00:17:56,000

it's also connected timelessly to the

444

00:18:03,159 --> 00:17:59,740

future how can anything that's timeless

445

00:18:04,720 --> 00:18:03,169

not be connected to all of time and some

446

00:18:06,940 --> 00:18:04,730

in some regard that the light that we're

447

00:18:08,919 --> 00:18:06,950

experiencing in the future is connected

448

00:18:13,360 --> 00:18:08,929

timelessly to the lights today it's hard

449

00:18:15,100 --> 00:18:13,370

to discuss it in physical words but if

450

00:18:17,080 --> 00:18:15,110

you contemplate timelessness I this is

451
00:18:21,190 --> 00:18:17,090
the conclusion I've come to the question

452
00:18:22,750 --> 00:18:21,200
is which tomorrow is it connected to if

453
00:18:24,190 --> 00:18:22,760
light is timeless which time which

454
00:18:26,080 --> 00:18:24,200
tomorrow is that connected to is the

455
00:18:30,039 --> 00:18:26,090
future predetermined it would seem that

456
00:18:31,690 --> 00:18:30,049
way but I would say no light exists in

457
00:18:33,430 --> 00:18:31,700
all the possible futures and so now

458
00:18:35,379 --> 00:18:33,440
we've landed on the conclusion that all

459
00:18:40,389 --> 00:18:35,389
these possible features exist that light

460
00:18:42,519 --> 00:18:40,399
is timelessly connected to and since

461
00:18:44,500 --> 00:18:42,529
light must always real aim remain

462
00:18:46,830 --> 00:18:44,510
timeless it can never objectively

463
00:18:49,240 --> 00:18:46,840

collapse to a single definite state if

464

00:18:51,490 --> 00:18:49,250

light ever objectively took a definite

465

00:18:56,799 --> 00:18:51,500

state then it would mean that I was

466

00:19:00,129 --> 00:18:56,809

changing the future of that light as

467

00:19:02,200 --> 00:19:00,139

well in some objective way which doesn't

468

00:19:06,310 --> 00:19:02,210

make sense with the principle that light

469

00:19:07,930 --> 00:19:06,320

would be timeless and so the where I

470

00:19:10,210 --> 00:19:07,940

take that is the relational collapse

471

00:19:14,049 --> 00:19:10,220

model the light only takes a definite

472

00:19:15,310 --> 00:19:14,059

state relative to me the observer and so

473

00:19:17,950 --> 00:19:15,320

any description is relative to an

474

00:19:19,720 --> 00:19:17,960

observer so compatible interpretations

475

00:19:22,450 --> 00:19:19,730

that use this idea of relational

476

00:19:25,299 --> 00:19:22,460

collapse many worlds many minds

477

00:19:27,430 --> 00:19:25,309

consistent histories relational quantum

478

00:19:28,930 --> 00:19:27,440

Bayesian ISM and decoherence Theory

479

00:19:30,789 --> 00:19:28,940

decoherence is not really an

480

00:19:34,450 --> 00:19:30,799

interpretation but it met it fits with

481

00:19:36,310 --> 00:19:34,460

this transactional to state vector

482

00:19:40,090 --> 00:19:36,320

formalism are both possibly compatible I

483

00:19:41,200 --> 00:19:40,100

haven't figured it out yet incompatible

484

00:19:42,610 --> 00:19:41,210

interpretations and this is where I

485

00:19:44,680 --> 00:19:42,620

think it's very interesting and relevant

486

00:19:46,509 --> 00:19:44,690

the Penrose interpretation anything

487

00:19:47,980 --> 00:19:46,519

involving objective reduction or

488

00:19:51,930 --> 00:19:47,990

objective collapse doesn't fit this

489

00:19:55,120 --> 00:19:51,940

model grw the Copenhagen interpretation

490

00:19:56,649 --> 00:19:55,130

simply said that macroscopic can't be

491

00:19:58,299 --> 00:19:56,659

separate from microscopic if you follow

492

00:19:59,860 --> 00:19:58,309

this model that would that would imply

493

00:20:00,910 --> 00:19:59,870

some kind of objective reality that just

494

00:20:03,640 --> 00:20:00,920

can't be the case with

495

00:20:05,200 --> 00:20:03,650

Relativity de broglie-bohm von Oy Minh

496

00:20:06,790 --> 00:20:05,210

and the varmint stop and staff

497

00:20:08,230 --> 00:20:06,800

interpretations although in discussion

498

00:20:09,250 --> 00:20:08,240

with Henry step I think we've might have

499

00:20:14,040 --> 00:20:09,260

brought them a little closer to the

500

00:20:17,500 --> 00:20:14,050

relational view so that's ongoing a

501
00:20:19,570 --> 00:20:17,510
definite objective world out there does

502
00:20:21,550 --> 00:20:19,580
not need consciousness but the

503
00:20:26,800 --> 00:20:21,560
relational world has a natural place for

504
00:20:29,470 --> 00:20:26,810
consciousness the observer so physical

505
00:20:31,720 --> 00:20:29,480
reality is secondary takes definite form

506
00:20:36,910 --> 00:20:31,730
inside consciousness and consciousness

507
00:20:44,770 --> 00:20:36,920
is primary thank you very much thank you

508
00:20:46,150 --> 00:20:44,780
very much thank you quick question and

509
00:20:49,660 --> 00:20:46,160
just just to mention I have a book that

510
00:20:51,430 --> 00:20:49,670
will be coming out in December and some

511
00:20:53,470 --> 00:20:51,440
experiments that are suggested for this

512
00:20:54,640 --> 00:20:53,480
and I love any of any of you who would

513
00:20:59,440 --> 00:20:54,650

like to review it I'd love to give you a

514

00:21:04,750 --> 00:20:59,450

copy thanks guy your idea of the

515

00:21:09,490 --> 00:21:04,760

timelessness of light supports my idea

516

00:21:13,870 --> 00:21:09,500

of the symmetry of causality and retro

517

00:21:16,900 --> 00:21:13,880

causality and also Richard Shoup

518

00:21:20,850 --> 00:21:16,910

statement that causality has no real

519

00:21:24,040 --> 00:21:20,860

meaning because what you have described

520

00:21:29,710 --> 00:21:24,050

cause and effect are coexistent and

521

00:21:33,310 --> 00:21:29,720

don't need to be separated I think

522

00:21:35,950 --> 00:21:33,320

that's the point of so cause and effect

523

00:21:40,270 --> 00:21:35,960

become very problematic or interesting I

524

00:21:43,420 --> 00:21:40,280

might say if events that come you know

525

00:21:47,290 --> 00:21:43,430

if to light these events are not

526
00:21:49,690 --> 00:21:47,300
separate or distinct a B and C but to me

527
00:21:52,210 --> 00:21:49,700
as an inertial observer they are

528
00:21:54,310 --> 00:21:52,220
distinct causality is obviously true for

529
00:21:58,360 --> 00:21:54,320
me but how does that work with something

530
00:22:00,850 --> 00:21:58,370
that's that's timeless and has all

531
00:22:02,470 --> 00:22:00,860
possible events sort of it's connected

532
00:22:05,500 --> 00:22:02,480
to all those possible events at the same

533
00:22:06,730 --> 00:22:05,510
time I think it leads to conclusions I

534
00:22:09,430 --> 00:22:06,740
think you can draw conclusions but it

535
00:22:10,750 --> 00:22:09,440
takes a lot of deep thinking and it

536
00:22:13,690 --> 00:22:10,760
doesn't again I'm not saying that

537
00:22:14,640 --> 00:22:13,700
there's there's no causality for us for

538
00:22:16,680 --> 00:22:14,650

a human observer

539

00:22:17,730 --> 00:22:16,690

we already know what the world does the

540

00:22:19,080 --> 00:22:17,740

experiments are there and we're

541

00:22:21,090 --> 00:22:19,090

following those this is saying that

542

00:22:22,650 --> 00:22:21,100

there's some implications when you

543

00:22:27,180 --> 00:22:22,660

consider the lightest timeless but it's

544

00:22:29,280 --> 00:22:27,190

a great it's a great point no sky as you

545

00:22:33,330 --> 00:22:29,290

know we've talked about this admit from

546

00:22:37,200 --> 00:22:33,340

merely from your last presentation last

547

00:22:40,650 --> 00:22:37,210

weekend and I'm wondering what you've

548

00:22:42,540 --> 00:22:40,660

thought about the possibility that that

549

00:22:45,960 --> 00:22:42,550

which is spaceless and timeless a

550

00:22:50,460 --> 00:22:45,970

primordial non-existent void would

551

00:22:52,320 --> 00:22:50,470

intersect dynamically with space time

552

00:22:55,640 --> 00:22:52,330

energy and matter mind and body however

553

00:22:58,460 --> 00:22:55,650

quantum mechanically classically and be

554

00:23:03,110 --> 00:22:58,470

simultaneous in time and space as

555

00:23:06,350 --> 00:23:03,120

evidenced by light as a timeless

556

00:23:09,720 --> 00:23:06,360

possibly an arc discharge of some kind

557

00:23:14,040 --> 00:23:09,730

interacting between the void and

558

00:23:16,590 --> 00:23:14,050

space-time well the reason I love

559

00:23:18,690 --> 00:23:16,600

studying this is because it's in my view

560

00:23:24,600 --> 00:23:18,700

profound and interesting and hard to

561

00:23:28,290 --> 00:23:24,610

form conclusions I would I'd have to

562

00:23:32,550 --> 00:23:28,300

think about that some more and I think

563

00:23:34,500 --> 00:23:32,560

that the idea of a void is very

564

00:23:35,670 --> 00:23:34,510

consistent with the idea of timelessness

565

00:23:37,680 --> 00:23:35,680

they're both things that we cannot

566

00:23:41,100 --> 00:23:37,690

possibly describe with our current

567

00:23:43,800 --> 00:23:41,110

language and models and so quite

568

00:23:49,430 --> 00:23:43,810

possibly similar met descriptions of

569

00:23:59,670 --> 00:23:56,370

in the observations of photons arriving

570

00:24:02,610 --> 00:23:59,680

on earth that originated at the

571

00:24:06,360 --> 00:24:02,620

beginning of the universe it says that

572

00:24:08,490 --> 00:24:06,370

as we observe those photons we're not

573

00:24:11,760 --> 00:24:08,500

really looking at something that

574

00:24:14,330 --> 00:24:11,770

occurred in the past but since the

575

00:24:17,910 --> 00:24:14,340

photons are timeless we are literally

576
00:24:20,910 --> 00:24:17,920
looking at those events at the moment

577
00:24:29,440 --> 00:24:24,730
well disregarding and anything I've said

578
00:24:31,870 --> 00:24:29,450
if blue light is emitted but if a

579
00:24:35,230 --> 00:24:31,880
pattern of blue and green lights say is

580
00:24:37,540 --> 00:24:35,240
emitted from a star 100,000 years ago

581
00:24:39,370 --> 00:24:37,550
that's 100,000 light years away and we

582
00:24:42,550 --> 00:24:39,380
see it and we see that pattern we're

583
00:24:45,070 --> 00:24:42,560
seeing light as it was emitted I mean

584
00:24:46,600 --> 00:24:45,080
that we're seeing the event now but

585
00:24:48,760 --> 00:24:46,610
we're making the assumption that it

586
00:24:50,230 --> 00:24:48,770
happened a long time ago which I don't

587
00:24:52,390 --> 00:24:50,240
want to really call an assumption I

588
00:24:55,110 --> 00:24:52,400

think the point that you're getting at

589

00:24:58,240 --> 00:24:55,120

is that light if it's it's absolutely

590

00:25:01,090 --> 00:24:58,250

rigorously true I think that light

591

00:25:03,010 --> 00:25:01,100

because you can't consider it to have

592

00:25:05,890 --> 00:25:03,020

taken any particular time to get there

593

00:25:09,040 --> 00:25:05,900

because light has dilated completely I

594

00:25:12,610 --> 00:25:09,050

mean the process time is zero it does in

595

00:25:14,050 --> 00:25:12,620

some sense instantaneously connect the

596

00:25:16,060 --> 00:25:14,060

distance star and the observation of

597

00:25:17,230 --> 00:25:16,070

that distance star but it takes a long

598

00:25:18,580 --> 00:25:17,240

time from a earthbound observers

599

00:25:20,680 --> 00:25:18,590

reference frame for the light to make

600

00:25:22,210 --> 00:25:20,690

that distance and and in there is the

601

00:25:24,640 --> 00:25:22,220

dynamics that we're trying to uncover

602

00:25:26,890 --> 00:25:24,650

here thank you thank you very much sky

603

00:25:28,570 --> 00:25:26,900

we're running at least 20 minutes late

604

00:25:29,890 --> 00:25:28,580

so I'm going to kind of cut off the

605

00:25:32,680 --> 00:25:29,900

questions and I'll turn the mic over to

606

00:25:34,790 --> 00:25:32,690

Roger for 30 seconds

607

00:25:40,659 --> 00:25:34,800

[Applause]