



1
00:00:09,919 --> 00:00:05,690
thank you it's an honor to give I think

2
00:00:12,200 --> 00:00:09,929
the last talk and thank you for sticking

3
00:00:15,259 --> 00:00:12,210
around I'll try to be somewhat

4
00:00:26,599 --> 00:00:15,269
interesting if I can I want to talk

5
00:00:39,110 --> 00:00:26,609
about talking about why this doesn't

6
00:00:44,510 --> 00:00:39,120
work all right then all right we got one

7
00:00:48,139 --> 00:00:44,520
slide that's good well I want to talk

8
00:00:50,869 --> 00:00:48,149
about where it all starts the

9
00:00:52,310 --> 00:00:50,879
foundations the the the deeper

10
00:00:54,200 --> 00:00:52,320
understanding that we would all like

11
00:00:56,029 --> 00:00:54,210
about what's going on in the world and

12
00:00:58,549 --> 00:00:56,039
particularly what's going on in the

13
00:01:02,029 --> 00:00:58,559

universe as a whole how it got this way

14

00:01:04,189 --> 00:01:02,039

and how any understanding that we might

15

00:01:06,679 --> 00:01:04,199

have of the universe as a whole could be

16

00:01:08,539 --> 00:01:06,689

applied locally to our own situations

17

00:01:12,399 --> 00:01:08,549

and to some of the phenomenon that we're

18

00:01:20,210 --> 00:01:17,140

Bernie talked about the constants of the

19

00:01:22,429 --> 00:01:20,220

universe and physical laws of the

20

00:01:24,880 --> 00:01:22,439

universe and I won't say a whole lot

21

00:01:27,230 --> 00:01:24,890

more about that but it's worth just

22

00:01:29,690 --> 00:01:27,240

reflecting on the fact that it seems

23

00:01:31,850 --> 00:01:29,700

that there are a few numbers a few

24

00:01:34,069 --> 00:01:31,860

constants a few parameters that

25

00:01:38,510 --> 00:01:34,079

determine a great deal of what goes on

26
00:01:40,330 --> 00:01:38,520
in the universe and the phenomenon that

27
00:01:44,060 --> 00:01:40,340
takes place within it and these

28
00:01:47,120 --> 00:01:44,070
constants seem at least to be somewhat

29
00:01:49,429 --> 00:01:47,130
independent and rather arbitrary and yet

30
00:01:53,569 --> 00:01:49,439
we know that in several cases these

31
00:01:55,219 --> 00:01:53,579
constants are very finely tuned to

32
00:01:57,499 --> 00:01:55,229
support the kind of universe that we see

33
00:01:59,569 --> 00:01:57,509
in the life that we experience here and

34
00:02:01,370 --> 00:01:59,579
if they were different the universe

35
00:02:05,139 --> 00:02:01,380
would have been different and we would

36
00:02:07,160 --> 00:02:05,149
not have evolved to have noticed this so

37
00:02:09,050 --> 00:02:07,170
there's a question about how it got

38
00:02:11,510 --> 00:02:09,060

there how those constants got that way

39

00:02:13,610 --> 00:02:11,520

and by the way how did all that stuff

40

00:02:16,160 --> 00:02:13,620

get out there in particular

41

00:02:19,759 --> 00:02:16,170

places how did all this get to be the

42

00:02:21,380 --> 00:02:19,769

way it is even if we knew what those

43

00:02:22,640 --> 00:02:21,390

constants those parameters were the

44

00:02:24,680 --> 00:02:22,650

determined the physical laws and the

45

00:02:26,330 --> 00:02:24,690

properties of matter and energy we would

46

00:02:29,509 --> 00:02:26,340

still have this question of the initial

47

00:02:32,149 --> 00:02:29,519

condition why is it that the cosmic

48

00:02:35,149 --> 00:02:32,159

background radiation the oldest thing we

49

00:02:36,680 --> 00:02:35,159

can measure is not uniform as a matter

50

00:02:37,009 --> 00:02:36,690

of fact it seems to have some pattern to

51

00:02:42,740 --> 00:02:37,019

it

52

00:02:44,449 --> 00:02:42,750

get that way and how are these

53

00:02:50,990 --> 00:02:44,459

parameters derived in the first place

54

00:02:55,190 --> 00:02:51,000

well let me talk about oh that's

55

00:02:59,539 --> 00:02:55,200

interesting this is interesting I think

56

00:03:08,990 --> 00:02:59,549

you have my presentation from last year

57

00:03:10,550 --> 00:03:09,000

or two years ago that there's a slide

58

00:03:15,289 --> 00:03:10,560

that wasn't in there well it's alright

59

00:03:17,210 --> 00:03:15,299

we'll go on yeah there's there's

60

00:03:22,430 --> 00:03:17,220

something that got scrambled in the file

61

00:03:33,430 --> 00:03:22,440

it's alright yeah let's just do it this

62

00:03:43,820 --> 00:03:36,490

yeah I'm sorry but we've got the wrong

63

00:03:48,410 --> 00:03:43,830

presentation can we look at the stick

64

00:03:51,350 --> 00:03:48,420

again yeah could the universe be some

65

00:03:53,450 --> 00:03:51,360

other way the constants could be

66

00:03:55,550 --> 00:03:53,460

determined a lot of different ways here

67

00:03:58,580 --> 00:03:55,560

are four of them by some supernatural

68

00:03:59,900 --> 00:03:58,590

being perhaps they've determined random

69

00:04:01,610 --> 00:03:59,910

and there are a lot of different sub

70

00:04:03,590 --> 00:04:01,620

universes that have different values for

71

00:04:08,560 --> 00:04:03,600

these constants in which case we sort of

72

00:04:12,470 --> 00:04:10,880

this constants and those laws could have

73

00:04:14,660 --> 00:04:12,480

been in some way determined by our

74

00:04:17,810 --> 00:04:14,670

interactions with them our observations

75

00:04:22,460 --> 00:04:17,820

we created all by observing somewhat

76

00:04:24,350 --> 00:04:22,470

like similar previous talk or the the

77

00:04:26,200 --> 00:04:24,360

case that I'm more interested in perhaps

78

00:04:28,790 --> 00:04:26,210

that these constant really aren't

79

00:04:30,590 --> 00:04:28,800

independent and arbitrary but rather are

80

00:04:32,300 --> 00:04:30,600

mathematically derived and related in

81

00:04:33,860 --> 00:04:32,310

some interesting way so I'll give a

82

00:04:37,040 --> 00:04:33,870

couple of thoughts about that I'm

83

00:04:39,650 --> 00:04:37,050

reminded of Clarke's third law and by

84

00:04:40,909 --> 00:04:39,660

the way he added a fourth law in 99 for

85

00:04:44,690 --> 00:04:40,919

every expert there's an equal and

86

00:04:46,580 --> 00:04:44,700

opposite expert if if you've ever been

87

00:04:52,070 --> 00:04:46,590

involved in patent litigation as I have

88

00:04:53,810 --> 00:04:52,080

this is very apropos so I think it's any

89

00:04:55,700 --> 00:04:53,820

sufficiently advanced technology is

90

00:04:58,909 --> 00:04:55,710

indistinguishable from God we're really

91

00:05:00,830 --> 00:04:58,919

not imaginative enough to think of what

92

00:05:05,270 --> 00:05:00,840

advanced technology really advanced

93

00:05:07,550 --> 00:05:05,280

technology could be like and to say as

94

00:05:09,680 --> 00:05:07,560

some would say that they can't be here

95

00:05:11,930 --> 00:05:09,690

because it would violate the speed of

96

00:05:13,820 --> 00:05:11,940

light and too much energy has involved

97

00:05:16,670 --> 00:05:13,830

in all that kind of stuff is nonsense

98

00:05:18,440 --> 00:05:16,680

they have complete control of time and

99

00:05:22,159 --> 00:05:18,450

space and a lot more things that we

100

00:05:23,900 --> 00:05:22,169

haven't even thought of yet so if you

101
00:05:25,159 --> 00:05:23,910
think you have a guardian angel or some

102
00:05:28,370 --> 00:05:25,169
interaction with God

103
00:05:30,590 --> 00:05:28,380
I don't see any way to rule out that as

104
00:05:33,710 --> 00:05:30,600
being interaction with really advanced

105
00:05:35,510 --> 00:05:33,720
beings and advanced technology but

106
00:05:38,060 --> 00:05:35,520
beside the point back to physical

107
00:05:40,969 --> 00:05:38,070
constants here are some of them Bernie

108
00:05:42,680 --> 00:05:40,979
gave a nice summary of of a particular

109
00:05:45,140 --> 00:05:42,690
list Michio Kaku thinks maybe there are

110
00:05:47,180 --> 00:05:45,150
19 numbers numerate says John Baez

111
00:05:49,070 --> 00:05:47,190
counts 26 numbers

112
00:05:52,820 --> 00:05:49,080
Martin Reese's book just six numbers

113
00:05:54,830 --> 00:05:52,830

which is a very nice read derives the

114

00:05:57,320 --> 00:05:54,840

basis in an entirely different way using

115

00:05:59,600 --> 00:05:57,330

dimensionless numbers number of spatial

116

00:06:01,430 --> 00:05:59,610

dimensions and so on another interesting

117

00:06:03,920 --> 00:06:01,440

way of saying how many degrees of

118

00:06:06,110 --> 00:06:03,930

freedom are there maybe the real number

119

00:06:09,950 --> 00:06:06,120

is somewhere between six and twenty six

120

00:06:11,390 --> 00:06:09,960

I don't I don't know the usual

121

00:06:13,430 --> 00:06:11,400

assumptions that are made before we

122

00:06:15,830 --> 00:06:13,440

start thinking about these things I have

123

00:06:18,740 --> 00:06:15,840

some trouble with not because the

124

00:06:19,850 --> 00:06:18,750

principles are necessarily invalid for

125

00:06:21,370 --> 00:06:19,860

any reason but because of the way

126

00:06:23,990 --> 00:06:21,380

they're usually thought about

127

00:06:26,390 --> 00:06:24,000

materialism usually means there's stuff

128

00:06:28,760 --> 00:06:26,400

out there there are things in space

129

00:06:31,460 --> 00:06:28,770

whether those things are particles and

130

00:06:35,750 --> 00:06:31,470

fields or whether they are strings or

131

00:06:37,520 --> 00:06:35,760

some other abstract structure I'm much

132

00:06:39,430 --> 00:06:37,530

more tending these days toward thinking

133

00:06:42,410 --> 00:06:39,440

about differences and boundaries and

134

00:06:44,930 --> 00:06:42,420

transitions rather than the objects to

135

00:06:46,520 --> 00:06:44,940

me the the difference is to find the

136

00:06:48,890 --> 00:06:46,530

objects not the other way around

137

00:06:50,930 --> 00:06:48,900

and there's some precedents for this or

138

00:06:54,230 --> 00:06:50,940

maybe be able to go into that a little

139

00:06:55,370 --> 00:06:54,240

bit more later reductionism the idea

140

00:06:57,380 --> 00:06:55,380

that the whole is equal to sum of the

141

00:06:58,850 --> 00:06:57,390

parts people always say no now something

142

00:07:00,680 --> 00:06:58,860

emerges when you get all the parts

143

00:07:03,050 --> 00:07:00,690

together that wasn't there among the

144

00:07:04,909 --> 00:07:03,060

parts forgetting that if you know the

145

00:07:06,560 --> 00:07:04,919

parts and all their interactions you

146

00:07:08,270 --> 00:07:06,570

really do have the whole nevertheless

147

00:07:10,670 --> 00:07:08,280

three reductionism is not the only way

148

00:07:12,650 --> 00:07:10,680

to understand things and I would like to

149

00:07:14,480 --> 00:07:12,660

promote more constructivism that is

150

00:07:16,580 --> 00:07:14,490

starting from first principles or no

151
00:07:18,800 --> 00:07:16,590
principles and building upwards as well

152
00:07:20,290 --> 00:07:18,810
as reductionism taking things apart and

153
00:07:23,570 --> 00:07:20,300
trying to figure out how they work so

154
00:07:25,790 --> 00:07:23,580
the usual interpretation of that bothers

155
00:07:27,710 --> 00:07:25,800
me a bit randomness and the idea that

156
00:07:31,670 --> 00:07:27,720
there are truly causeless events at the

157
00:07:32,990 --> 00:07:31,680
core of physics I've totally bogus that

158
00:07:34,310 --> 00:07:33,000
one it seems to me that quantum

159
00:07:35,510 --> 00:07:34,320
measurement is not random at all and

160
00:07:38,240 --> 00:07:35,520
there's a big mistake that we've been

161
00:07:40,100 --> 00:07:38,250
making by making that assumption and it

162
00:07:42,800 --> 00:07:40,110
is an assumption in quantum mechanics it

163
00:07:45,110 --> 00:07:42,810

just happens to work very well so we

164

00:07:46,610 --> 00:07:45,120

believe it but I don't think anything is

165

00:07:48,650 --> 00:07:46,620

truly random in the sense of being

166

00:07:50,900 --> 00:07:48,660

causeless event even at the core of

167

00:07:52,850 --> 00:07:50,910

physics cause and effects might might be

168

00:07:54,680 --> 00:07:52,860

the most pernicious about of these in

169

00:07:56,620 --> 00:07:54,690

the sense that everyone thinks about

170

00:07:59,779 --> 00:07:56,630

cause and effect as a unidirectional

171

00:08:00,830 --> 00:07:59,789

thing and Liat this leads to the idea of

172

00:08:02,300 --> 00:08:00,840

time as a dimension

173

00:08:04,850 --> 00:08:02,310

and flowing in one direction and so on

174

00:08:06,110 --> 00:08:04,860

bad idea it seems to me that physics is

175

00:08:09,110 --> 00:08:06,120

telling us that everything is

176

00:08:11,360 --> 00:08:09,120

symmetrical in time and that all

177

00:08:15,530 --> 00:08:11,370

relationships of the causal nature are

178

00:08:17,629 --> 00:08:15,540

bi-directional and influence travels in

179

00:08:20,090 --> 00:08:17,639

both directions if we take these

180

00:08:21,350 --> 00:08:20,100

assumptions and formalize them in some

181

00:08:23,360 --> 00:08:21,360

way we usually get what's called a

182

00:08:26,840 --> 00:08:23,370

system of axioms you could say the

183

00:08:28,939 --> 00:08:26,850

standard model of physics is a kind of

184

00:08:31,520 --> 00:08:28,949

set of formal assumptions quantum theory

185

00:08:33,800 --> 00:08:31,530

in mathematics set theory and predicate

186

00:08:35,300 --> 00:08:33,810

calculus and so forth so we tend to

187

00:08:38,930 --> 00:08:35,310

formalize this and one might say that

188

00:08:41,329 --> 00:08:38,940

the more complex well let's say the less

189

00:08:43,279 --> 00:08:41,339

complex the set of axioms and beliefs

190

00:08:44,810 --> 00:08:43,289

are the more likely it is that we're

191

00:08:46,460 --> 00:08:44,820

close to the bottom that we're close to

192

00:08:48,650 --> 00:08:46,470

really understanding something or closer

193

00:08:51,560 --> 00:08:48,660

to bedrock and the more complex things

194

00:08:54,380 --> 00:08:51,570

are the rivers so here's an example from

195

00:08:57,110 --> 00:08:54,390

mathematics the Ximena Franco and the

196

00:09:00,019 --> 00:08:57,120

axiom of choice set theory eight axioms

197

00:09:03,200 --> 00:09:00,029

two of which at least are infinite axiom

198

00:09:05,570 --> 00:09:03,210

schema now I ask you does this look like

199

00:09:07,910 --> 00:09:05,580

we really understand the foundations of

200

00:09:09,260 --> 00:09:07,920

set theory or maybe sets are not such a

201

00:09:13,519 --> 00:09:09,270

good idea in the first place which is

202

00:09:15,949 --> 00:09:13,529

where where it's where I go Henry won't

203

00:09:17,570 --> 00:09:15,959

want car a said later generations will

204

00:09:19,699 --> 00:09:17,580

regard set theory as a disease from

205

00:09:21,380 --> 00:09:19,709

which one has recovered what we haven't

206

00:09:23,060 --> 00:09:21,390

recovered yet this is really one of the

207

00:09:27,400 --> 00:09:23,070

most fundamental things that are taught

208

00:09:30,230 --> 00:09:27,410

in mathematics congruent versus deep

209

00:09:31,790 --> 00:09:30,240

models a congruent model is really a

210

00:09:35,570 --> 00:09:31,800

kind of a theory it's an abstract

211

00:09:38,570 --> 00:09:35,580

something another that we sometimes try

212

00:09:40,730 --> 00:09:38,580

to tune to be the same shape as whatever

213

00:09:43,310 --> 00:09:40,740

it is we're modeling and so the more

214

00:09:45,740 --> 00:09:43,320

tuning is necessary that added

215

00:09:48,470 --> 00:09:45,750

assumptions and FUD factors show up and

216

00:09:50,449 --> 00:09:48,480

and this is not necessarily explaining

217

00:09:52,730 --> 00:09:50,459

things but merely modeling them so we

218

00:09:55,820 --> 00:09:52,740

can do stuff and try things to the model

219

00:09:58,820 --> 00:09:55,830

that will then be reflected in the in

220

00:10:00,650 --> 00:09:58,830

the real world somehow whereas a deeper

221

00:10:02,210 --> 00:10:00,660

model has something that's simpler and

222

00:10:04,820 --> 00:10:02,220

it was really more fundamental and more

223

00:10:07,040 --> 00:10:04,830

like how it really is how the the

224

00:10:08,960 --> 00:10:07,050

phenomenon or whatever it is is actually

225

00:10:10,190 --> 00:10:08,970

generated and tells us something more

226

00:10:13,100 --> 00:10:10,200

about its place in the world

227

00:10:14,180 --> 00:10:13,110

here are some discrete physical models

228

00:10:15,800 --> 00:10:14,190

that I think are

229

00:10:17,660 --> 00:10:15,810

really becoming more and more

230

00:10:19,880 --> 00:10:17,670

interesting

231

00:10:21,740 --> 00:10:19,890

string theory hasn't quite paid off but

232

00:10:23,870 --> 00:10:21,750

still there's something very importantly

233

00:10:26,090 --> 00:10:23,880

correct about it even if it's not the

234

00:10:30,140 --> 00:10:26,100

whole story even in the standard model

235

00:10:32,000 --> 00:10:30,150

group symmetries as an abstract idea can

236

00:10:34,880 --> 00:10:32,010

model three of the four forces at least

237

00:10:37,490 --> 00:10:34,890

in some respects some of you may have

238

00:10:39,730 --> 00:10:37,500

seen causal dynamical triangulations a

239

00:10:42,440 --> 00:10:39,740

terrible name if I've ever heard one

240

00:10:45,440 --> 00:10:42,450

it's the cover story in scientific

241

00:10:48,680 --> 00:10:45,450

Scientific American this month by Renata

242

00:10:51,730 --> 00:10:48,690

Lowe and some others they claim to have

243

00:10:54,350 --> 00:10:51,740

derived from first principles the

244

00:10:58,520 --> 00:10:54,360

dimensionality of our space three plus

245

00:11:00,770 --> 00:10:58,530

one or four dimensions questionable

246

00:11:02,450 --> 00:11:00,780

again but again I bring these forward

247

00:11:05,060 --> 00:11:02,460

just to say here's an interesting

248

00:11:07,520 --> 00:11:05,070

direction and this kind of thing is what

249

00:11:11,950 --> 00:11:07,530

we ought to be looking at Garrett Lisi

250

00:11:15,830 --> 00:11:11,960

in the ee_8 Lee algebra showed up as a

251
00:11:18,560 --> 00:11:15,840
possible candidate for a theory of

252
00:11:20,330 --> 00:11:18,570
everything last year and Steven

253
00:11:21,860 --> 00:11:20,340
Wolfram's new kind of science which is

254
00:11:24,140 --> 00:11:21,870
tries to explain everything in terms of

255
00:11:27,290 --> 00:11:24,150
cellular automata again a very abstract

256
00:11:31,310 --> 00:11:27,300
notion at the base of it all here's the

257
00:11:34,160 --> 00:11:31,320
e8 Theory 248 dimensional Lie algebra if

258
00:11:37,730 --> 00:11:34,170
you decompose this into various parts

259
00:11:39,830 --> 00:11:37,740
sub algebra Lie would say that you get

260
00:11:43,610 --> 00:11:39,840
a very good correspondence to gravity

261
00:11:44,900 --> 00:11:43,620
the forces particles and so on some

262
00:11:46,460 --> 00:11:44,910
people who know a lot more group theory

263
00:11:48,500 --> 00:11:46,470

in mathematical physics and I do have

264

00:11:51,610 --> 00:11:48,510

said this really doesn't map well and

265

00:11:53,870 --> 00:11:51,620

it's not the answer but it's a good try

266

00:11:56,030 --> 00:11:53,880

so let's go to the other end of the

267

00:11:57,829 --> 00:11:56,040

spectrum the the simplest possible thing

268

00:12:00,079 --> 00:11:57,839

what's the simplest possible thing we

269

00:12:02,150 --> 00:12:00,089

could imagine in the abstract where

270

00:12:05,300 --> 00:12:02,160

what's the starting place for everything

271

00:12:09,079 --> 00:12:05,310

that we must all share and the answer I

272

00:12:11,750 --> 00:12:09,089

think is nothing the void and I don't

273

00:12:13,870 --> 00:12:11,760

mean the vacuum the empty set any of

274

00:12:16,160 --> 00:12:13,880

that kind of stuff I mean nothing

275

00:12:18,230 --> 00:12:16,170

suppose we take nothing we take the

276

00:12:21,350 --> 00:12:18,240

smallest step we can away from nothing

277

00:12:24,500 --> 00:12:21,360

what would that be something it doesn't

278

00:12:26,060 --> 00:12:24,510

have a name it's not nothing okay that's

279

00:12:27,170 --> 00:12:26,070

the first distinction this is from G

280

00:12:30,500 --> 00:12:27,180

Spencer Browns

281

00:12:32,750 --> 00:12:30,510

laws of form two distinctions can be

282

00:12:34,280 --> 00:12:32,760

made in two different ways cardinality

283

00:12:36,650 --> 00:12:34,290

and bosons flow from the first

284

00:12:38,180 --> 00:12:36,660

ordinality and Fermo fermions from the

285

00:12:40,660 --> 00:12:38,190

second so I think we're really onto

286

00:12:43,690 --> 00:12:40,670

something here

287

00:12:46,310 --> 00:12:43,700

some friends in Great Britain took this

288

00:12:48,680 --> 00:12:46,320

idea which they developed separately by

289

00:12:52,640 --> 00:12:48,690

the way not from Spencer Brown and tried

290

00:12:54,200 --> 00:12:52,650

to make a hierarchy of groups by

291

00:12:55,610 --> 00:12:54,210

instantiating the number of different

292

00:12:59,990 --> 00:12:55,620

things you could distinguish at each

293

00:13:07,520 --> 00:13:00,000

level 2 3 7 and 127 the total number of

294

00:13:10,850 --> 00:13:07,530

symbols then is 2 3 10 137 and really

295

00:13:12,740 --> 00:13:10,860

big now this caught their attention

296

00:13:14,270 --> 00:13:12,750

because 137 is very close to the

297

00:13:17,630 --> 00:13:14,280

reciprocal of the fine-structure

298

00:13:20,570 --> 00:13:17,640

constant and 3 10 137 and really big are

299

00:13:22,910 --> 00:13:20,580

something like the ratios of the

300

00:13:24,320 --> 00:13:22,920

strengths of the four forces so this

301
00:13:25,790 --> 00:13:24,330
group has been looking to this quite a

302
00:13:27,440 --> 00:13:25,800
bit further than I can tell you about he

303
00:13:28,760 --> 00:13:27,450
ran out and again I don't know whether

304
00:13:31,220 --> 00:13:28,770
this is going anywhere or not but it

305
00:13:33,170 --> 00:13:31,230
certainly is interesting

306
00:13:35,150 --> 00:13:33,180
stepping to relativity everybody knows

307
00:13:38,210 --> 00:13:35,160
that Lorentz transformation of the

308
00:13:40,280 --> 00:13:38,220
Lorentz factor is very critical and

309
00:13:41,840 --> 00:13:40,290
connected to lots of things in physics

310
00:13:45,380 --> 00:13:41,850
as you can see from this diagram in

311
00:13:47,510 --> 00:13:45,390
Lucas and Hodgson's book and they go in

312
00:13:51,110 --> 00:13:47,520
the in the into this book and derive

313
00:13:52,490 --> 00:13:51,120

Lorentz factors from a wide variety of

314

00:13:54,670 --> 00:13:52,500

different viewpoints there's something

315

00:13:57,410 --> 00:13:54,680

very important about the Lorentz factor

316

00:13:59,870 --> 00:13:57,420

but I'd like to see it described and

317

00:14:02,840 --> 00:13:59,880

derived discretely so here I have an

318

00:14:07,220 --> 00:14:02,850

object and a very very simple notion of

319

00:14:09,230 --> 00:14:07,230

motion that is to say if it moves 1 if

320

00:14:12,320 --> 00:14:09,240

it moves to the right I count +1 if it

321

00:14:15,650 --> 00:14:12,330

moves to the left I count minus 1 that's

322

00:14:19,910 --> 00:14:15,660

the simplest possible definition of

323

00:14:22,310 --> 00:14:19,920

motion I can think of there's no rulers

324

00:14:24,140 --> 00:14:22,320

here there's no clocks when it moves I

325

00:14:26,660 --> 00:14:24,150

kick my clock if it moves in either

326

00:14:30,230 --> 00:14:26,670

direction I take my clock and I keep

327

00:14:32,960 --> 00:14:30,240

track of by counting these dimensionless

328

00:14:34,640 --> 00:14:32,970

things how far it's moved here's the

329

00:14:36,260 --> 00:14:34,650

number that it moves plus minus the

330

00:14:39,829 --> 00:14:36,270

number it moved - that's kind of a

331

00:14:41,480 --> 00:14:39,839

distance the number it moved plus plus

332

00:14:43,850 --> 00:14:41,490

the number of times it moved in the

333

00:14:45,800 --> 00:14:43,860

other direction and that's sort of a

334

00:14:47,540 --> 00:14:45,810

time but we have no independent clocks

335

00:14:50,119 --> 00:14:47,550

whatsoever so we turn that into a

336

00:14:54,710 --> 00:14:50,129

probability using a the sum of these

337

00:14:56,720 --> 00:14:54,720

accounts and for simplicity in the

338

00:14:59,230 --> 00:14:56,730

algebra and we can note right away

339

00:15:02,449 --> 00:14:59,240

there's a maximum velocity which is one

340

00:15:04,759 --> 00:15:02,459

one step per tick if all the movement is

341

00:15:07,970 --> 00:15:04,769

in one direction that's plus C if it's

342

00:15:10,939 --> 00:15:07,980

all it to the left it's minus C now

343

00:15:13,040 --> 00:15:10,949

let's take two such things and try to

344

00:15:15,949 --> 00:15:13,050

add the two velocities together this is

345

00:15:18,769 --> 00:15:15,959

like firing a gun from the front of a

346

00:15:21,199 --> 00:15:18,779

rocket ship let's say so we're going to

347

00:15:22,850 --> 00:15:21,209

watch just the second object which is

348

00:15:24,590 --> 00:15:22,860

moving in a similar way but relative to

349

00:15:27,499 --> 00:15:24,600

the first object so that these things

350

00:15:29,379 --> 00:15:27,509

add up so I add them up here's the first

351

00:15:32,119 --> 00:15:29,389

velocity here's the second velocity and

352

00:15:34,699 --> 00:15:32,129

look look at these two terms right here

353

00:15:36,379 --> 00:15:34,709

when number one goes in to the left and

354

00:15:37,730 --> 00:15:36,389

number two goes to the right we don't

355

00:15:40,879 --> 00:15:37,740

see anything because they cancelled each

356

00:15:42,470 --> 00:15:40,889

other out when number two goes to the

357

00:15:44,749 --> 00:15:42,480

right and number one goes to the left

358

00:15:48,079 --> 00:15:44,759

there's we're cancelling and we don't

359

00:15:51,230 --> 00:15:48,089

take our clock either no no time passes

360

00:15:53,929 --> 00:15:51,240

so we do the mathematics on that just a

361

00:15:58,069 --> 00:15:53,939

little simple algebra gives you this

362

00:16:02,840 --> 00:15:58,079

answer and sure enough one plus $V^1 V^1$

363

00:16:04,730 --> 00:16:02,850

V 2 is in the denominator so all steps

364

00:16:06,079 --> 00:16:04,740

are still size 1 C is equal to 1 and

365

00:16:08,119 --> 00:16:06,089

when you add the velocities together you

366

00:16:10,369 --> 00:16:08,129

get exactly the factor that special

367

00:16:12,350 --> 00:16:10,379

relativity would tell you can we derive

368

00:16:14,480 --> 00:16:12,360

all of special relativity from this idea

369

00:16:18,049 --> 00:16:14,490

I don't know I haven't done it yet stay

370

00:16:20,090 --> 00:16:18,059

tuned but the idea is that we started it

371

00:16:21,949 --> 00:16:20,100

with something extremely simple before

372

00:16:25,869 --> 00:16:21,959

the usual notions of space and time and

373

00:16:29,860 --> 00:16:25,879

we got to something very quickly that

374

00:16:33,910 --> 00:16:29,870

gives us special relativity relativistic

375

00:16:35,860 --> 00:16:33,920

additive velocities summary summarizing

376

00:16:38,569 --> 00:16:35,870

the constants

377

00:16:40,100 --> 00:16:38,579

seem arbitrary but they might be purely

378

00:16:43,040 --> 00:16:40,110

mathematical and there might be a lot to

379

00:16:45,860 --> 00:16:43,050

be learned about them from studying them

380

00:16:48,740 --> 00:16:45,870

as abstract mathematical objects and

381

00:16:50,809 --> 00:16:48,750

deductions I'm advocating construction

382

00:16:53,449 --> 00:16:50,819

rather than or in addition to the usual

383

00:16:56,230 --> 00:16:53,459

reductionist approach combinatorics and

384

00:16:58,639 --> 00:16:56,240

fourth seem to be very important

385

00:17:00,650 --> 00:16:58,649

suggesting the idea of dick distinction

386

00:17:04,189 --> 00:17:00,660

or difference as prior to object and

387

00:17:06,649 --> 00:17:04,199

maybe the ultimate origins and the idea

388

00:17:08,720 --> 00:17:06,659

of discrete motion from pre space and

389

00:17:11,269 --> 00:17:08,730

time and relativistic velocity addition

390

00:17:13,549 --> 00:17:11,279

may ask you a question how many I've

391

00:17:17,529 --> 00:17:13,559

ever heard of this discrete derivation

392

00:17:22,100 --> 00:17:17,539

of velocity addition before nobody okay

393

00:17:24,860 --> 00:17:22,110

thanks it was due to urban Stein and Tom

394

00:17:28,010 --> 00:17:24,870

Meador as I may have said and we're

395

00:17:30,139 --> 00:17:28,020

exploring that a lot further we're

396

00:17:31,399 --> 00:17:30,149

always seeking funding to continue this

397

00:17:46,940 --> 00:17:31,409

research so if anybody's interested

398

00:17:49,909 --> 00:17:46,950

please let me know thank you minutes for

399

00:17:57,260 --> 00:17:49,919

questions and it looks like Dave Leiter

400

00:18:00,760 --> 00:17:57,270

got his hand up first Richard this is

401
00:18:03,549 --> 00:18:00,770
more a an observation than a question

402
00:18:06,860 --> 00:18:03,559
one of the first books that I read

403
00:18:08,539 --> 00:18:06,870
entering into this whole realm and I

404
00:18:11,690 --> 00:18:08,549
think I remember it correctly he was

405
00:18:15,620 --> 00:18:11,700
called cosmic consciousness by Maurice

406
00:18:19,760 --> 00:18:15,630
Burke and what he predicted was that

407
00:18:23,330 --> 00:18:19,770
humanity was gradually becoming more and

408
00:18:27,019 --> 00:18:23,340
more and more intelligent and I'm almost

409
00:18:29,960 --> 00:18:27,029
seeing that happen between the speakers

410
00:18:32,299 --> 00:18:29,970
and and the audience we're kind of

411
00:18:37,669 --> 00:18:32,309
gathered for that that purpose and

412
00:18:51,850 --> 00:18:37,679
because of that growing ability it's a

413
00:18:55,510 --> 00:18:54,130

okay I sort of thought the speaker might

414

00:19:03,040 --> 00:18:55,520

have something to say in response any

415

00:19:05,440 --> 00:19:03,050

other questions I did I'd like to know

416

00:19:08,500 --> 00:19:05,450

what the implications are of the so

417

00:19:11,020 --> 00:19:08,510

called cosmic axis of evil on your model

418

00:19:14,920 --> 00:19:11,030

this idea that the universe has a kites

419

00:19:15,970 --> 00:19:14,930

not distributed evenly you mentioned it

420

00:19:17,050 --> 00:19:15,980

briefly at the beginning of your talk

421

00:19:20,170 --> 00:19:17,060

the background radiation

422

00:19:23,920 --> 00:19:20,180

have some kind of a pattern in it and

423

00:19:26,740 --> 00:19:23,930

there's an area where there's where it's

424

00:19:30,430 --> 00:19:26,750

kind of sparse I have no idea it seems

425

00:19:32,800 --> 00:19:30,440

to me no more interesting than why are

426

00:19:36,820 --> 00:19:32,810

why is that galaxy over here rather than

427

00:19:39,280 --> 00:19:36,830

over there but there's got to be a ton

428

00:19:41,620 --> 00:19:39,290

of information provided some from

429

00:19:43,090 --> 00:19:41,630

someplace so where did that come from is

430

00:19:47,500 --> 00:19:43,100

a very good question but on the other

431

00:19:50,950 --> 00:19:47,510

hand if I gave you a huge number let's

432

00:19:53,110 --> 00:19:50,960

see a huge integer that was oh I don't

433

00:19:56,950 --> 00:19:53,120

know ten to the hundredth digits long or

434

00:19:58,900 --> 00:19:56,960

something like that could I ask you to

435

00:20:00,910 --> 00:19:58,910

tell me how much information is in that

436

00:20:03,370 --> 00:20:00,920

integer in other words how much would it

437

00:20:05,170 --> 00:20:03,380

take in information terms to distinguish

438

00:20:07,870 --> 00:20:05,180

that integer from all other integers of

439

00:20:09,430 --> 00:20:07,880

the same size well it might take a while

440

00:20:12,010 --> 00:20:09,440

to figure out whether or not that it's a

441

00:20:15,520 --> 00:20:12,020

highly composite number I gave you or a

442

00:20:17,260 --> 00:20:15,530

prime or or what and the amount of

443

00:20:19,450 --> 00:20:17,270

information contained in a very complex

444

00:20:22,630 --> 00:20:19,460

thing is not always clear that's my

445

00:20:24,760 --> 00:20:22,640

point so if you think in terms of really

446

00:20:27,130 --> 00:20:24,770

really really huge numbers it might be

447

00:20:29,260 --> 00:20:27,140

that there's less complexity required to

448

00:20:31,750 --> 00:20:29,270

specify this universe then we would

449

00:20:33,070 --> 00:20:31,760

first think I don't know maybe there's a

450

00:20:35,560 --> 00:20:33,080

lot more patterns that we have not

451
00:20:39,190 --> 00:20:35,570
discerned yet both mathematically and

452
00:20:44,230 --> 00:20:39,200
physically I'm going to get in trouble

453
00:20:45,850 --> 00:20:44,240
for glossing the cosmologists but the

454
00:20:48,250 --> 00:20:45,860
question about the fluctuation in the

455
00:20:50,380 --> 00:20:48,260
background radiation is the current

456
00:20:52,150 --> 00:20:50,390
explanation for why that galaxies over

457
00:20:54,210 --> 00:20:52,160
there yes yes right and this one's over

458
00:20:57,970 --> 00:20:54,220
here and there was a literal conversion

459
00:20:59,100 --> 00:20:57,980
experience in 1990 when the Cobain data

460
00:21:00,990 --> 00:20:59,110
was presented at that

461
00:21:11,190 --> 00:21:01,000
in Florida and they all of a sudden

462
00:21:20,230 --> 00:21:16,090
as you stated randomness is an

463
00:21:24,670 --> 00:21:20,240

assumption that most scientists just

464

00:21:27,100 --> 00:21:24,680

take for granted and get you and a few

465

00:21:30,100 --> 00:21:27,110

others including myself seriously

466

00:21:32,500 --> 00:21:30,110

question that assumption how is it that

467

00:21:34,450 --> 00:21:32,510

you have come to that conclusion if you

468

00:21:36,910 --> 00:21:34,460

can tell us briefly and what

469

00:21:39,100 --> 00:21:36,920

significance does that have for the

470

00:21:41,230 --> 00:21:39,110

evolution of the framework that you're

471

00:21:44,490 --> 00:21:41,240

taking how did I get to the dark side

472

00:21:47,650 --> 00:21:44,500

[Laughter]

473

00:21:51,010 --> 00:21:47,660

well first of all quantum randomness has

474

00:21:55,390 --> 00:21:51,020

been the most controversial kind of

475

00:21:56,770 --> 00:21:55,400

thing contained in in the quantum

476

00:21:58,240 --> 00:21:56,780

measurement problem since the beginning

477

00:21:58,660 --> 00:21:58,250

even the founders didn't like it very

478

00:22:02,140 --> 00:21:58,670

much

479

00:22:05,530 --> 00:22:02,150

and yet it works so very well but I was

480

00:22:10,120 --> 00:22:05,540

I guess first started thinking about

481

00:22:11,620 --> 00:22:10,130

this by some physicists the one that

482

00:22:13,720 --> 00:22:11,630

comes to mind it might not have been the

483

00:22:15,970 --> 00:22:13,730

first that I read but anyway surf and

484

00:22:20,190 --> 00:22:15,980

Adame nicholas urfe and chris Adame at

485

00:22:24,340 --> 00:22:20,200

at Caltech wrote a paper about this

486

00:22:26,380 --> 00:22:24,350

that's been widely ignored and there are

487

00:22:30,100 --> 00:22:26,390

some other justifications for it in

488

00:22:32,170 --> 00:22:30,110

purely quantum theory terms so that got

489

00:22:32,620 --> 00:22:32,180

me started then I started to think about

490

00:22:36,160 --> 00:22:32,630

it

491

00:22:38,320 --> 00:22:36,170

more and look at the evidence from sy4

492

00:22:40,300 --> 00:22:38,330

backwards causation and for backwards

493

00:22:42,730 --> 00:22:40,310

causation this suddenly solves the

494

00:22:44,620 --> 00:22:42,740

problem so it clicked together for me

495

00:22:46,360 --> 00:22:44,630

and the more I look the more I see

496

00:22:49,450 --> 00:22:46,370

evidence that things are symmetrical in

497

00:22:51,430 --> 00:22:49,460

time preparation measurement exactly

498

00:22:55,750 --> 00:22:51,440

symmetrical if you think about that for

499

00:22:58,480 --> 00:22:55,760

a while and I think you have a lot of

500

00:23:00,700 --> 00:22:58,490

things clear up ok unfortunately we're

501

00:23:02,840 --> 00:23:00,710

out of time for questions or discussion