

1
00:00:00,000 --> 00:00:05,209
orion scientific Scientific American

2
00:00:01,439 --> 00:00:07,950
this month by renata low and some others

3
00:00:05,209 --> 00:00:11,580
they claim to have derived from first

4
00:00:07,950 --> 00:00:15,740
principles the dimensionality of our

5
00:00:11,580 --> 00:00:18,570
space 3 plus 1 or 4 dimensions

6
00:00:15,740 --> 00:00:20,460
questionable again but again I bring

7
00:00:18,570 --> 00:00:22,050
these forward just to say here's an

8
00:00:20,460 --> 00:00:24,589
interesting direction and this kind of

9
00:00:22,050 --> 00:00:29,670
thing is what we ought to be looking at

10
00:00:24,589 --> 00:00:33,899
Garrett Lisi n the e8 Lee algebra showed

11
00:00:29,670 --> 00:00:36,809
up as a possible candidate for a theory

12
00:00:33,899 --> 00:00:38,670
of everything last year and Stephen

13
00:00:36,808 --> 00:00:40,049
Wolfram's new kind of science which is

14
00:00:38,670 --> 00:00:42,510
tries to explain everything in terms of

15
00:00:40,049 --> 00:00:45,509
cellular automata again a very abstract

16
00:00:42,509 --> 00:00:49,500
notion at the base of it all here's the

17
00:00:45,509 --> 00:00:52,409
e8 Theory 248 dimensional ly algebra if

18
00:00:49,500 --> 00:00:55,980
you decompose this into various parts

19
00:00:52,409 --> 00:00:58,229
subalgebra Lisi would say that you get a

20
00:00:55,979 --> 00:01:02,128
very good correspondence to gravity the

21
00:00:58,229 --> 00:01:03,238
forces particles and so on some people

22
00:01:02,128 --> 00:01:04,890
who know a lot more group theory in

23
00:01:03,238 --> 00:01:06,868
mathematical physics and I do have said

24
00:01:04,890 --> 00:01:10,829
this really doesn't map well and it's

25
00:01:06,868 --> 00:01:12,090
not the answer but it's a good try so

26
00:01:10,829 --> 00:01:14,429
let's go to the other end of the

27
00:01:12,090 --> 00:01:16,170
spectrum the the simplest possible thing

28
00:01:14,430 --> 00:01:18,299
what's the simplest possible thing we

29

00:01:16,170 --> 00:01:20,368
could imagine in the abstract where

30
00:01:18,299 --> 00:01:23,520
what's the starting place for everything

31
00:01:20,368 --> 00:01:27,420
that we must all share and the answer I

32
00:01:23,519 --> 00:01:30,000
think is nothing the void and i don't

33
00:01:27,420 --> 00:01:32,090
mean the vacuum the empty set any of

34
00:01:30,000 --> 00:01:34,379
that kind of stuff i mean nothing

35
00:01:32,090 --> 00:01:36,420
suppose we take nothing we take the

36
00:01:34,379 --> 00:01:39,478
smallest step we can away from nothing

37
00:01:36,420 --> 00:01:42,719
what would that be something it doesn't

38
00:01:39,478 --> 00:01:44,280
have a name it's not nothing okay that's

39
00:01:42,719 --> 00:01:47,368
the first distinction this is from G

40
00:01:44,280 --> 00:01:49,618
Spencer Brown's laws of form two

41
00:01:47,368 --> 00:01:51,569
distinctions can be made in two

42
00:01:49,618 --> 00:01:53,578
different ways cardinality and bosons

43
00:01:51,569 --> 00:01:55,769

flow from the first Order ality and

44

00:01:53,578 --> 00:01:59,879

fermions from the second so I think

45

00:01:55,769 --> 00:02:02,908

we're really onto something here some

46

00:01:59,879 --> 00:02:04,589

friends in Great Britain took this idea

47

00:02:02,909 --> 00:02:07,020

which they developed separately by the

48

00:02:04,590 --> 00:02:10,860

way not from Spencer brown and tried to

49

00:02:07,019 --> 00:02:12,449

make a hierarchy of groups by

50

00:02:10,860 --> 00:02:13,620

instantiating the number of different

51

00:02:12,449 --> 00:02:17,969

things you could distinguish

52

00:02:13,620 --> 00:02:25,049

at each level 2 37 and 127 the total

53

00:02:17,969 --> 00:02:28,769

number of symbols then is to 310 137 and

54

00:02:25,049 --> 00:02:30,599

really big now this caught their

55

00:02:28,769 --> 00:02:32,489

attention because 137 is very close to

56

00:02:30,598 --> 00:02:35,848

the reciprocal of the fine-structure

57

00:02:32,489 --> 00:02:38,700

constant and 310 137 and really big are

58

00:02:35,848 --> 00:02:41,128
something like the ratios of the

59

00:02:38,699 --> 00:02:42,539
strengths of the four forces so this

60

00:02:41,128 --> 00:02:44,039
group has been looking to this quite a

61

00:02:42,539 --> 00:02:45,659
bit further than i can tell you about he

62

00:02:44,039 --> 00:02:46,979
ran out and again i don't know whether

63

00:02:45,659 --> 00:02:50,039
this is going anywhere not but it

64

00:02:46,979 --> 00:02:51,780
certainly is interesting stepping to

65

00:02:50,039 --> 00:02:53,669
relativity everybody knows that low

66

00:02:51,780 --> 00:02:57,329
rents transformation that the Lorentz

67

00:02:53,669 --> 00:02:59,098
factor is very critical and connected to

68

00:02:57,329 --> 00:03:02,000
lots of things in physics as you can see

69

00:02:59,098 --> 00:03:04,709
from this diagram in Lucas and Hodgson's

70

00:03:02,000 --> 00:03:08,068
book and they go in the in the into this

71

00:03:04,709 --> 00:03:10,170
book and derive Lawrence factors from a

72
00:03:08,068 --> 00:03:11,429
wide variety of different viewpoints

73
00:03:10,169 --> 00:03:14,399
there's something very important about

74
00:03:11,430 --> 00:03:17,129
the Lorentz factor but I'd like to see

75
00:03:14,400 --> 00:03:20,010
it described and derived discreetly so

76
00:03:17,128 --> 00:03:22,709
here i have an object and a very very

77
00:03:20,009 --> 00:03:26,039
simple notion of motion that is to say

78
00:03:22,709 --> 00:03:27,930
if it moves one if it moves to the right

79
00:03:26,039 --> 00:03:32,759
i count plus one if it moves to the left

80
00:03:27,930 --> 00:03:34,620
i count minus one that's the simplest

81
00:03:32,759 --> 00:03:38,668
possible definition of motion i can

82
00:03:34,620 --> 00:03:41,549
think of there's no rulers here there's

83
00:03:38,669 --> 00:03:43,049
no clocks when it moves I took my clock

84
00:03:41,549 --> 00:03:46,879
if it moves in either direction i took

85
00:03:43,049 --> 00:03:50,250
my clock and i keep track of by counting

86

00:03:46,878 --> 00:03:51,840
these dimensionless things how far it's

87
00:03:50,250 --> 00:03:53,759
moved here's the number that it moves

88
00:03:51,840 --> 00:03:55,799
plus minus the number it moved minus

89
00:03:53,759 --> 00:03:59,340
that's kind of a distance the number it

90
00:03:55,799 --> 00:04:01,650
moved plus plus the number of times it

91
00:03:59,340 --> 00:04:03,299
moved in the other direction and that's

92
00:04:01,650 --> 00:04:05,310
sort of a time but we have no

93
00:04:03,299 --> 00:04:07,859
independent clocks whatsoever so we turn

94
00:04:05,310 --> 00:04:12,840
that into a probability using a the sum

95
00:04:07,859 --> 00:04:15,030
of these accounts and for simplicity in

96
00:04:12,840 --> 00:04:17,449
the algebra and we can note right away

97
00:04:15,030 --> 00:04:20,668
there's a maximum velocity which is one

98
00:04:17,449 --> 00:04:23,009
one step or tick if all the movement is

99
00:04:20,668 --> 00:04:26,189
in one direction that's plus C if it's

100
00:04:23,009 --> 00:04:27,449

all it to the left it's minus C now

101

00:04:26,189 --> 00:04:30,300

let's take two such thing

102

00:04:27,449 --> 00:04:32,519

and try to add the two velocities

103

00:04:30,300 --> 00:04:36,540

together this is like firing a gun from

104

00:04:32,519 --> 00:04:38,039

the front of a rocket ship let's say so

105

00:04:36,540 --> 00:04:40,230

we're going to watch just the second

106

00:04:38,040 --> 00:04:42,629

object which is moving in a similar way

107

00:04:40,230 --> 00:04:44,879

but relative to the first object so that

108

00:04:42,629 --> 00:04:46,500

these things add up so I add them up

109

00:04:44,879 --> 00:04:49,259

here's the first velocity here's the

110

00:04:46,500 --> 00:04:51,360

second velocity and look look at these

111

00:04:49,259 --> 00:04:53,789

two terms right here when number one

112

00:04:51,360 --> 00:04:54,990

goes in to the left and number two goes

113

00:04:53,790 --> 00:04:56,250

to the right we don't see anything

114

00:04:54,990 --> 00:04:59,550

because they canceled each other out

115
00:04:56,250 --> 00:05:01,589
when number two goes to the right and

116
00:04:59,550 --> 00:05:03,629
number one goes to the left there's are

117
00:05:01,589 --> 00:05:07,739
canceling and we don't take our clock

118
00:05:03,629 --> 00:05:10,259
either no no time passes so we do the

119
00:05:07,740 --> 00:05:13,560
mathematics on that just a little simple

120
00:05:10,259 --> 00:05:17,849
algebra gives you this answer and sure

121
00:05:13,560 --> 00:05:21,629
enough one plus v_1 v_2 is in the

122
00:05:17,850 --> 00:05:23,310
denominator so all steps are still size

123
00:05:21,629 --> 00:05:25,409
1 c is equal to 1 and when you add the

124
00:05:23,310 --> 00:05:27,089
velocities together you get exactly the

125
00:05:25,410 --> 00:05:29,430
factor that special relativity would

126
00:05:27,089 --> 00:05:30,989
tell you can we derive all of special

127
00:05:29,430 --> 00:05:34,800
relativity from this idea I don't know

128
00:05:30,990 --> 00:05:36,420
haven't done it yet stay tuned but the

129
00:05:34,800 --> 00:05:38,490
idea is that we started it with

130
00:05:36,420 --> 00:05:41,160
something extremely simple before the

131
00:05:38,490 --> 00:05:45,090
usual notions of space and time and we

132
00:05:41,160 --> 00:05:48,080
got to something very quickly that gives

133
00:05:45,089 --> 00:05:53,129
us special relativity relativistic

134
00:05:48,079 --> 00:05:56,310
additive velocities some summarizing the

135
00:05:53,129 --> 00:05:57,930
constants seem arbitrary but they might

136
00:05:56,310 --> 00:06:00,660
be purely mathematical and there might

137
00:05:57,930 --> 00:06:02,930
be a lot to be learned about them from

138
00:06:00,660 --> 00:06:05,990
studying them as abstract mathematical

139
00:06:02,930 --> 00:06:08,189
objects and deductions I'm advocating

140
00:06:05,990 --> 00:06:09,949
construction rather than or in addition

141
00:06:08,189 --> 00:06:12,269
to the usual reductionist approach

142
00:06:09,949 --> 00:06:15,899
combinatorics and so forth seem to be

143

00:06:12,269 --> 00:06:18,180
very important suggesting the idea of

144
00:06:15,899 --> 00:06:20,009
dick distinction or difference as prior

145
00:06:18,180 --> 00:06:24,360
to object and maybe the ultimate origins

146
00:06:20,009 --> 00:06:26,819
and the idea of discrete motion from pre

147
00:06:24,360 --> 00:06:29,280
space and time and relativistic velocity

148
00:06:26,819 --> 00:06:30,800
addition may ask you a question how many

149
00:06:29,279 --> 00:06:33,619
have ever heard of this discrete

150
00:06:30,800 --> 00:06:39,420
derivation of velocity addition before

151
00:06:33,620 --> 00:06:41,249
nobody ok thanks it was due to Irving

152
00:06:39,420 --> 00:06:45,259
Stein and Tom netter as I may have said

153
00:06:41,249 --> 00:06:48,028
and we're exploring that a lot further

154
00:06:45,259 --> 00:06:49,619
we're always seeking funding to continue

155
00:06:48,028 --> 00:07:05,158
this research so if anybody's interested

156
00:06:49,619 --> 00:07:08,159
please let me know thank you minutes for

157
00:07:05,158 --> 00:07:15,329

questions and it looks like Dave lighter

158

00:07:08,158 --> 00:07:20,399

got his hand up first Richard this is

159

00:07:15,329 --> 00:07:23,249

more a observe ation one of the first

160

00:07:20,399 --> 00:07:25,559

books that i read entering into this

161

00:07:23,249 --> 00:07:27,869

whole realm and i think i remember

162

00:07:25,559 --> 00:07:32,159

correctly he was called cosmic

163

00:07:27,869 --> 00:07:35,809

consciousness by maurice burke and what

164

00:07:32,158 --> 00:07:38,519

he predicted was that humanity was

165

00:07:35,809 --> 00:07:42,149

gradually becoming more and more and

166

00:07:38,519 --> 00:07:46,259

more intelligent and i'm almost seeing

167

00:07:42,149 --> 00:07:48,899

that happen between the speakers and and

168

00:07:46,259 --> 00:07:52,528

the audience we're kind of gathered for

169

00:07:48,899 --> 00:07:56,488

that that purpose and because of that

170

00:07:52,528 --> 00:07:58,699

growing ability it's a great sentiment

171

00:07:56,488 --> 00:07:58,698

thanks

172
00:08:09,839 --> 00:08:13,769
okay I sort of thought the speaker might

173
00:08:12,360 --> 00:08:21,270
have something to say in response any

174
00:08:13,769 --> 00:08:23,339
other questions I did I'd like to know

175
00:08:21,269 --> 00:08:26,339
what the implications are of the

176
00:08:23,339 --> 00:08:28,799
so-called cosmic axis of evil on your

177
00:08:26,339 --> 00:08:33,088
model this idea that the universe has

178
00:08:28,800 --> 00:08:34,200
its not distributed evenly you mentioned

179
00:08:33,089 --> 00:08:35,550
it briefly at the beginning of your talk

180
00:08:34,200 --> 00:08:37,229
the background radiation yeah the

181
00:08:35,549 --> 00:08:39,899
background radiation seems to have some

182
00:08:37,229 --> 00:08:42,419
kind of a pattern in it and there's an

183
00:08:39,899 --> 00:08:46,259
area where there's where it's kind of

184
00:08:42,418 --> 00:08:49,649
sparse I have no idea it seems to me no

185
00:08:46,259 --> 00:08:51,860
more interesting than yr why is that

186
00:08:49,649 --> 00:08:55,079
galaxy over here rather than over there

187
00:08:51,860 --> 00:08:57,800
but there's got to be a ton of

188
00:08:55,080 --> 00:09:00,060
information provided some from someplace

189
00:08:57,799 --> 00:09:04,079
so where did that come from is a very

190
00:09:00,059 --> 00:09:06,299
good question but on the other hand if i

191
00:09:04,080 --> 00:09:09,720
gave you a huge number let's see a huge

192
00:09:06,299 --> 00:09:11,639
integer that was oh I don't know ten to

193
00:09:09,720 --> 00:09:16,080
the hundredth digits long or something

194
00:09:11,639 --> 00:09:18,208
like that could I ask you to tell me how

195
00:09:16,080 --> 00:09:19,650
much information is in that integer in

196
00:09:18,208 --> 00:09:21,778
other words how much would it take in

197
00:09:19,649 --> 00:09:23,458
information terms to distinguish that

198
00:09:21,778 --> 00:09:26,370
integer from all other integers of the

199
00:09:23,458 --> 00:09:27,659
same size well it might take a while to

200

00:09:26,370 --> 00:09:30,240
figure out whether or not that it's a

201
00:09:27,659 --> 00:09:33,750
highly composite number I gave you or a

202
00:09:30,240 --> 00:09:35,490
prime or or what and the amount of

203
00:09:33,750 --> 00:09:37,708
information contained in a very complex

204
00:09:35,490 --> 00:09:40,740
thing is not always clear that's my

205
00:09:37,708 --> 00:09:42,989
point so if you think in terms of really

206
00:09:40,740 --> 00:09:45,360
really really huge numbers it might be

207
00:09:42,990 --> 00:09:47,459
that there's less complexity required to

208
00:09:45,360 --> 00:09:49,980
specify this universe then we would

209
00:09:47,458 --> 00:09:51,269
first think I don't know maybe there's a

210
00:09:49,980 --> 00:09:53,789
lot more patterns that we have not

211
00:09:51,269 --> 00:09:57,149
discerned yet both mathematically and

212
00:09:53,789 --> 00:10:01,490
physically I'm going to get in trouble

213
00:09:57,149 --> 00:10:01,490
for glossing the