1
00:00:05,200 --> 00:00:01,429
orion scientific Scientific American

2
00:00:07,940 --> 00:00:05,210
this month by renata low and some others

3
00:00:11,570 --> 00:00:07,950
they claim to have derived from first

4
00:00:15,730 --> 00:00:11,580
principles the dimensionality of our

5
00:00:18,560 --> 00:00:15,740
space 3 plus 1 or 4 dimensions

6
00:00:20,450 --> 00:00:18,570
questionable again but again I bring

7
00:00:22,040 --> 00:00:20,460
these forward just to say here's an

8
00:00:24,580 --> 00:00:22,050
interesting direction and this kind of

9
00:00:29,660 --> 00:00:24,590
thing is what we ought to be looking at

10
00:00:33,889 --> 00:00:29,670
Garrett Lisi n the e8 Lee algebra showed

11
00:00:36,799 --> 00:00:33,899
up as a possible candidate for a theory

12
00:00:38,660 --> 00:00:36,809
of everything last year and Stephen

13
00:00:40,040 --> 00:00:38,670

Wolfram's new kind of science which is

14
00:00:42,500 --> 00:00:40,050
tries to explain everything in terms of

15
00:00:45,500 --> 00:00:42,510
cellular automata again a very abstract

16
00:00:49,490 --> 00:00:45,510
notion at the base of it all here's the

17
00:00:52,400 --> 00:00:49,500
e8 Theory 248 dimensional ly algebra if

18
00:00:55,970 --> 00:00:52,410
you decompose this into various parts

19
00:00:58,220 --> 00:00:55,980
subalgebra Lisi would say that you get a

20
00:01:02,119 --> 00:00:58,230
very good correspondence to gravity the

21
00:01:03,229 --> 00:01:02,129
forces particles and so on some people

22
00:01:04,880 --> 00:01:03,239
who know a lot more group theory in

23
00:01:06,859 --> 00:01:04,890
mathematical physics and I do have said

24
00:01:10,820 --> 00:01:06,869
this really doesn't map well and it's

25
00:01:12,080 --> 00:01:10,830
not the answer but it's a good try so

26
00:01:14,420 --> 00:01:12,090
let's go to the other end of the

27
00:01:16,160 --> 00:01:14,430
spectrum the the simplest possible thing

28
00:01:18,289 --> 00:01:16,170
what's the simplest possible thing we

29
00:01:20,359 --> 00:01:18,299
could imagine in the abstract where

30
00:01:23,510 --> 00:01:20,369
what's the starting place for everything

31
00:01:27,410 --> 00:01:23,520
that we must all share and the answer I

32
00:01:29,990 --> 00:01:27,420
think is nothing the void and i don't

33
00:01:32,080 --> 00:01:30,000
mean the vacuum the empty set any of

34
00:01:34,370 --> 00:01:32,090
that kind of stuff i mean nothing

35
00:01:36,410 --> 00:01:34,380
suppose we take nothing we take the

36
00:01:39,469 --> 00:01:36,420
smallest step we can away from nothing

37
00:01:42,710 --> 00:01:39,479
what would that be something it doesn't

38
00:01:44,270 --> 00:01:42,720

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

39
00:01:47,359 --> 00:01:44,280
the first distinction this is from G

40
00:01:49,609 --> 00:01:47,369
Spencer Brown's laws of form two

41
00:01:51,560 --> 00:01:49,619
distinctions can be made in two

42
00:01:53,569 --> 00:01:51,570
different ways cardinality and bosons

43
00:01:55,760 --> 00:01:53,579
flow from the first Orden ality and

44
00:01:59,870 --> 00:01:55,770
fermions from the second so I think

45
00:02:02,899 --> 00:01:59,880
we're really onto something here some

46
00:02:04,580 --> 00:02:02,909
friends in Great Britain took this idea

47
00:02:07,010 --> 00:02:04,590
which they developed separately by the

48
00:02:10,850 --> 00:02:07,020
way not from Spencer brown and tried to

49
00:02:12,440 --> 00:02:10,860
make a hierarchy of groups by

50
00:02:13,610 --> 00:02:12,450
instantiating the number of different

51
00:02:17,960 --> 00:02:13,620
things you could distinguish

52
00:02:25,039 --> 00:02:17,970
at each level 2 37 and 127 the total

53
00:02:28,759 --> 00:02:25,049
number of symbols then is to 310 137 and

54
00:02:30,589 --> 00:02:28,769
really big now this caught their

55
00:02:32,479 --> 00:02:30,599
attention because 137 is very close to

56
00:02:35,839 --> 00:02:32,489
the reciprocal of the fine-structure

57
00:02:38,690 --> 00:02:35,849
constant and 310 137 and really big are

58
00:02:41,119 --> 00:02:38,700
something like the ratios of the

59
00:02:42,530 --> 00:02:41,129
strengths of the four forces so this

60
00:02:44,030 --> 00:02:42,540
group has been looking to this quite a

61
00:02:45,650 --> 00:02:44,040
bit further than i can tell you about he

62
00:02:46,970 --> 00:02:45,660
ran out and again i don't know whether

63
00:02:50,030 --> 00:02:46,980

this is going anywhere not but it

64
00:02:51,770 --> 00:02:50,040
certainly is interesting stepping to

65
00:02:53,660 --> 00:02:51,780
relativity everybody knows that low

66
00:02:57,319 --> 00:02:53,670
rents transformation that the Lorentz

67
00:02:59,089 --> 00:02:57,329
factor is very critical and connected to

68
00:03:01,990 --> 00:02:59,099
lots of things in physics as you can see

69
00:03:04,699 --> 00:03:02,000
from this diagram in Lucas and Hodgson's

70
00:03:08,059 --> 00:03:04,709
book and they go in the in the into this

71
00:03:10,160 --> 00:03:08,069
book and derive Lawrence factors from a

72
00:03:11,420 --> 00:03:10,170
wide variety of different viewpoints

73
00:03:14,390 --> 00:03:11,430
there's something very important about

74
00:03:17,119 --> 00:03:14,400
the Lorentz factor but I'd like to see

75
00:03:20,000 --> 00:03:17,129
it described and derived discreetly so

76
00:03:22,699 --> 00:03:20,010
here i have an object and a very very

77
00:03:26,030 --> 00:03:22,709
simple notion of motion that is to say

78
00:03:27,920 --> 00:03:26,040
if it moves one if it moves to the right

79
00:03:32,750 --> 00:03:27,930
i count plus one if it moves to the left

80
00:03:34,610 --> 00:03:32,760
i count minus one that's the simplest

81
00:03:38,659 --> 00:03:34,620
possible definition of motion i can

82
00:03:41,539 --> 00:03:38,669
think of there's no rulers here there's

83
00:03:43,039 --> 00:03:41,549
no clocks when it moves I took my clock

84
00:03:46,869 --> 00:03:43,049
if it moves in either direction i took

85
00:03:50,240 --> 00:03:46,879
my clock and i keep track of by counting

86
00:03:51,830 --> 00:03:50,250
these dimensionless things how far it's

87
00:03:53,750 --> 00:03:51,840
moved here's the number that it moves

88
00:03:55,789 --> 00:03:53,760

plus minus the number it moved minus

89
00:03:59,330 --> 00:03:55,799
that's kind of a distance the number it

90
00:04:01,640 --> 00:03:59,340
moved plus plus the number of times it

91
00:04:03,289 --> 00:04:01,650
moved in the other direction and that's

92
00:04:05,300 --> 00:04:03,299
sort of a time but we have no

93
00:04:07,849 --> 00:04:05,310
independent clocks whatsoever so we turn

94
00:04:12,830 --> 00:04:07,859
that into a probability using a the sum

95
00:04:15,020 --> 00:04:12,840
of these accounts and for simplicity in

96
00:04:17,439 --> 00:04:15,030
the algebra and we can note right away

97
00:04:20,659 --> 00:04:17,449
there's a maximum velocity which is one

98
00:04:23,000 --> 00:04:20,669
one step or tick if all the movement is

99
00:04:26,180 --> 00:04:23,010
in one direction that's plus C if it's

100
00:04:27,440 --> 00:04:26,190
all it to the left it's minus C now

101
00:04:30,290 --> 00:04:27,450
let's take two such thing

102
00:04:32,510 --> 00:04:30,300
and try to add the two velocities

103
00:04:36,530 --> 00:04:32,520
together this is like firing a gun from

104
00:04:38,030 --> 00:04:36,540
the front of a rocket ship let's say so

105
00:04:40,220 --> 00:04:38,040
we're going to watch just the second

106
00:04:42,620 --> 00:04:40,230
object which is moving in a similar way

107
00:04:44,870 --> 00:04:42,630
but relative to the first object so that

108
00:04:46,490 --> 00:04:44,880
these things add up so I add them up

109
00:04:49,250 --> 00:04:46,500
here's the first velocity here's the

110
00:04:51,350 --> 00:04:49,260
second velocity and look look at these

111
00:04:53,780 --> 00:04:51,360
two terms right here when number one

112
00:04:54,980 --> 00:04:53,790
goes in to the left and number two goes

113
00:04:56,240 --> 00:04:54,990

to the right we don't see anything

114
00:04:59,540 --> 00:04:56,250
because they canceled each other out

115
00:05:01,580 --> 00:04:59,550
when number two goes to the right and

116
00:05:03,620 --> 00:05:01,590
number one goes to the left there's are

117
00:05:07,730 --> 00:05:03,630
canceling and we don't take our clock

118
00:05:10,250 --> 00:05:07,740
either no no time passes so we do the

119
00:05:13,550 --> 00:05:10,260
mathematics on that just a little simple

120
00:05:17,840 --> 00:05:13,560
algebra gives you this answer and sure

121
00:05:21,620 --> 00:05:17,850
enough one plus v1 0 v 1 v 2 is in the

122
00:05:23,300 --> 00:05:21,630
denominator so all steps are still size

123
00:05:25,400 --> 00:05:23,310
1 c is equal to 1 and when you add the

124
00:05:27,080 --> 00:05:25,410
velocities together you get exactly the

125
00:05:29,420 --> 00:05:27,090
factor that special relativity would

126
00:05:30,980 --> 00:05:29,430
tell you can we derive all of special

127
00:05:34,790 --> 00:05:30,990
relativity from this idea I don't know

128
00:05:36,410 --> 00:05:34,800
haven't done it yet stay tuned but the

129
00:05:38,480 --> 00:05:36,420
idea is that we started it with

130
00:05:41,150 --> 00:05:38,490
something extremely simple before the

131
00:05:45,080 --> 00:05:41,160
usual notions of space and time and we

132
00:05:48,070 --> 00:05:45,090
got to something very quickly that gives

133
00:05:53,120 --> 00:05:48,080
us special relativity relativistic

134
00:05:56,300 --> 00:05:53,130
additive velocities some summarizing the

135
00:05:57,920 --> 00:05:56,310
constants seem arbitrary but they might

136
00:06:00,650 --> 00:05:57,930
be purely mathematical and there might

137
00:06:02,920 --> 00:06:00,660
be a lot to be learned about them from

138
00:06:05,980 --> 00:06:02,930

studying them as abstract mathematical

139
00:06:08,180 --> 00:06:05,990
objects and deductions I'm advocating

140
00:06:09,940 --> 00:06:08,190
construction rather than or in addition

141
00:06:12,260 --> 00:06:09,950
to the usual reductionist approach

142
00:06:15,890 --> 00:06:12,270
combinatorics and so forth seem to be

143
00:06:18,170 --> 00:06:15,900
very important suggesting the idea of

144
00:06:20,000 --> 00:06:18,180
dick distinction or difference as prior

145
00:06:24,350 --> 00:06:20,010
to object and maybe the ultimate origins

146
00:06:26,810 --> 00:06:24,360
and the idea of discrete motion from pre

147
00:06:29,270 --> 00:06:26,820
space and time and relativistic velocity

148
00:06:30,790 --> 00:06:29,280
addition may ask you a question how many

149
00:06:33,610 --> 00:06:30,800
have ever heard of this discrete

150
00:06:39,410 --> 00:06:33,620
derivation of velocity addition before

151
00:06:41,239 --> 00:06:39,420
nobody ok thanks it was due to Irving

152
00:06:45,249 --> 00:06:41,249
Stein and Tom netter as I may have said

153
00:06:48,019 --> 00:06:45,259
and we're exploring that a lot further

154
00:06:49,609 --> 00:06:48,029
we're always seeking funding to continue

155
00:07:05,149 --> 00:06:49,619
this research so if anybody's interested

156
00:07:08,149 --> 00:07:05,159
please let me know thank you minutes for

157
00:07:15,319 --> 00:07:08,159
questions and it looks like Dave lighter

158
00:07:20,389 --> 00:07:15,329
got his hand up first Richard this is

159
00:07:23,239 --> 00:07:20,399
more a observe ation one of the first

160
00:07:25,549 --> 00:07:23,249
books that i read entering into this

161
00:07:27,859 --> 00:07:25,559
whole realm and i think i remember

162
00:07:32,149 --> 00:07:27,869
correctly he was called cosmic

163
00:07:35,799 --> 00:07:32,159

consciousness by maurice burke and what

164
00:07:38,509 --> 00:07:35,809
he predicted was that humanity was

165
00:07:42,139 --> 00:07:38,519
gradually becoming more and more and

166
00:07:46,249 --> 00:07:42,149
more intelligent and i'm almost seeing

167
00:07:48,889 --> 00:07:46,259
that happen between the speakers and and

168
00:07:52,519 --> 00:07:48,899
the audience we're kind of gathered for

169
00:07:56,479 --> 00:07:52,529
that that purpose and because of that

170
00:08:09,830 --> 00:07:56,489
growing ability it's a great sentiment

171
00:08:13,760 --> 00:08:12,350
okay I sort of thought the speaker might

172
00:08:21,260 --> 00:08:13,770
have something to say in response any

173
00:08:23,330 --> 00:08:21,270
other questions I did I'd like to know

174
00:08:26,330 --> 00:08:23,340
what the implications are of the

175
00:08:28,790 --> 00:08:26,340
so-called cosmic axis of evil on your

176
00:08:33,079 --> 00:08:28,800
model this idea that the universe has

177
00:08:34,190 --> 00:08:33,089
its not distributed evenly you mentioned

178
00:08:35,540 --> 00:08:34,200
it briefly at the beginning of your talk

179
00:08:37,219 --> 00:08:35,550
the background radiation yeah the

180
00:08:39,890 --> 00:08:37,229
background radiation seems to have some

181
00:08:42,409 --> 00:08:39,900
kind of a pattern in it and there's an

182
00:08:46,250 --> 00:08:42,419
area where there's where it's kind of

183
00:08:49,640 --> 00:08:46,260
sparse I have no idea it seems to me no

184
00:08:51,850 --> 00:08:49,650
more interesting than yr why is that

185
00:08:55,070 --> 00:08:51,860
galaxy over here rather than over there

186
00:08:57,790 --> 00:08:55,080
but there's got to be a ton of

187
00:09:00,050 --> 00:08:57,800
information provided some from someplace

188
00:09:04,070 --> 00:09:00,060

so where did that come from is a very

189
00:09:06,290 --> 00:09:04,080
good question but on the other hand if i

190
00:09:09,710 --> 00:09:06,300
gave you a huge number let's see a huge

191
00:09:11,630 --> 00:09:09,720
integer that was oh I don't know ten to

192
00:09:16,070 --> 00:09:11,640
the hundredth digits long or something

193
00:09:18,199 --> 00:09:16,080
like that could I ask you to tell me how

194
00:09:19,640 --> 00:09:18,209
much information is in that integer in

195
00:09:21,769 --> 00:09:19,650
other words how much would it take in

196
00:09:23,449 --> 00:09:21,779
information terms to distinguish that

197
00:09:26,360 --> 00:09:23,459
integer from all other integers of the

198
00:09:27,650 --> 00:09:26,370
same size well it might take a while to

199
00:09:30,230 --> 00:09:27,660
figure out whether or not that it's a

200
00:09:33,740 --> 00:09:30,240
highly composite number I gave you or a

201
00:09:35,480 --> 00:09:33,750
prime or or what and the amount of

202
00:09:37,699 --> 00:09:35,490
information contained in a very complex

203
00:09:40,730 --> 00:09:37,709
thing is not always clear that's my

204
00:09:42,980 --> 00:09:40,740
point so if you think in terms of really

205
00:09:45,350 --> 00:09:42,990
really really huge numbers it might be

206
00:09:47,449 --> 00:09:45,360
that there's less complexity required to

207
00:09:49,970 --> 00:09:47,459
specify this universe then we would

208
00:09:51,260 --> 00:09:49,980
first think I don't know maybe there's a

209
00:09:53,780 --> 00:09:51,270
lot more patterns that we have not

210
00:09:57,140 --> 00:09:53,790
discerned yet both mathematically and