1
00:00:07,280 --> 00:00:03,919
in both directions at an equal rate so

2
00:00:09,350 --> 00:00:07,290
this cannot work and if we sit back for

3
00:00:12,620 --> 00:00:09,360
a moment and think about it we say of

4
00:00:14,930 --> 00:00:12,630
course it can't work because nature is

5
00:00:18,140 --> 00:00:14,940
full of nonlinearities biological matter

6
00:00:21,170 --> 00:00:18,150
has nonlinearities geological matter has

7
00:00:23,740 --> 00:00:21,180
nonlinearities and if in fact we could

8
00:00:25,580 --> 00:00:23,750
have nonlinearities to rectify

9
00:00:27,200 --> 00:00:25,590
fluctuations that would mean there'd be

10
00:00:29,660 --> 00:00:27,210
hot spots all over the place in nature

11
00:00:32,840 --> 00:00:29,670
wherever there was a non-linearity we

12
00:00:35,840 --> 00:00:32,850
don't find that this cannot work putting

13
00:00:38,240 --> 00:00:35,850

this in a more general term ratchets do

14
00:00:41,959 --> 00:00:38,250
not work in systems that are under

15
00:00:43,729 --> 00:00:41,969
equilibrium there was another patent

16
00:00:47,540 --> 00:00:43,739
that came out earlier by Franklin Mead

17
00:00:50,119 --> 00:00:47,550
which according to my analysis uses the

18
00:00:51,470 --> 00:00:50,129
same sort of principle this patent is

19
00:00:53,479 --> 00:00:51,480
called system for converting

20
00:00:57,290 --> 00:00:53,489
electromagnetic radiant radiation energy

21
00:00:59,299 --> 00:00:57,300
to electrical energy and what it uses

22
00:01:02,779 --> 00:00:59,309
are two spheres that are slightly

23
00:01:04,820 --> 00:01:02,789
dissimilar in size they create a beat

24
00:01:07,899 --> 00:01:04,830
frequency a beat resonance frequency

25
00:01:11,830 --> 00:01:07,909
between them which downshifts the

26
00:01:15,410 --> 00:01:11,840
zero-point energy vibrations to a lower

27
00:01:18,109 --> 00:01:15,420
frequency an antenna then absorbs this

28
00:01:20,450 --> 00:01:18,119
radiation it's rectified and we get out

29
00:01:23,510 --> 00:01:20,460
DC power it can't work for the same

30
00:01:26,240 --> 00:01:23,520
reason we're using a we're trying to

31
00:01:31,420 --> 00:01:26,250
rectify background radiation it doesn't

32
00:01:34,039 --> 00:01:31,430
work next mechanical extraction a Pinto

33
00:01:36,679 --> 00:01:34,049
wrote a number of patents a paper

34
00:01:38,539 --> 00:01:36,689
started a company based on this the

35
00:01:42,440 --> 00:01:38,549
method is called method for energy

36
00:01:47,050 --> 00:01:42,450
extraction in a paper he shows a Carnot

37
00:01:49,359 --> 00:01:47,060
cycle in which as with a normal car no

38
00:01:51,649 --> 00:01:49,369

system you can extract energy

39
00:01:54,740 --> 00:01:51,659
continuously by going around the cycle

40
00:01:57,859 --> 00:01:54,750
let's take a look at his basic concept

41
00:02:00,440 --> 00:01:57,869
so he has a Casimir cavity and in the

42
00:02:04,130 --> 00:02:00,450
Casimir cavity there are two plates that

43
00:02:06,770 --> 00:02:04,140
are attracted to each other we make use

44
00:02:09,460 --> 00:02:06,780
of this attraction and allow the plates

45
00:02:10,600 --> 00:02:09,470
to move together extract that energy

46
00:02:13,300 --> 00:02:10,610
then

47
00:02:15,610 --> 00:02:13,310
what he does is he essentially turns off

48
00:02:18,490 --> 00:02:15,620
one of those plates he extracts some

49
00:02:20,680 --> 00:02:18,500
electrons from it by various means that

50
00:02:24,730 --> 00:02:20,690
reduces the attractive force between the

51
00:02:26,740 --> 00:02:24,740
two plates then in step number three he

52
00:02:28,390 --> 00:02:26,750
can pull the plates apart more easily

53
00:02:30,910 --> 00:02:28,400
since the attractive force has been

54
00:02:34,450 --> 00:02:30,920
decreased then he replenishes the charge

55
00:02:36,790 --> 00:02:34,460
into the plates and then repeats the

56
00:02:39,760 --> 00:02:36,800
process and so he has a process that

57
00:02:44,350 --> 00:02:39,770
goes around and around so question is

58
00:02:49,240 --> 00:02:44,360
can you do this and the basic question

59
00:02:51,880 --> 00:02:49,250
is really is the zero-point force is the

60
00:02:53,350 --> 00:02:51,890
Casimir force a conservative force let

61
00:02:55,390 --> 00:02:53,360
me give you an example of a conservative

62
00:02:58,090 --> 00:02:55,400
force gravity is conservative so if I

63
00:02:59,830 --> 00:02:58,100

take a brick and I let a brick fall

64
00:03:02,140 --> 00:02:59,840
towards the earth and I extract the

65
00:03:04,300 --> 00:03:02,150
energy from it then when I lift the

66
00:03:06,699 --> 00:03:04,310
brick up to do the same thing again I

67
00:03:09,040 --> 00:03:06,709
use just as much energy to lift the

68
00:03:10,780 --> 00:03:09,050
brick up as I got by dropping it down

69
00:03:13,330 --> 00:03:10,790
that's an example of a conservative

70
00:03:15,400 --> 00:03:13,340
force well it turns out that the Casimir

71
00:03:17,320 --> 00:03:15,410
force is conservative there are a number

72
00:03:20,949 --> 00:03:17,330
of analyses that show that this is in

73
00:03:25,440 --> 00:03:20,959
fact the case that means that pentose

74
00:03:28,030 --> 00:03:25,450
idea cannot work in particular

75
00:03:30,850 --> 00:03:28,040
extracting the charge from one of those

76
00:03:33,310 --> 00:03:30,860
plates to reduce the Casimir force the

77
00:03:36,789 --> 00:03:33,320
process of extracting that charge must

78
00:03:38,800 --> 00:03:36,799
use at least as much energy as you get

79
00:03:41,500 --> 00:03:38,810
from letting the two Casimir plates fall

80
00:03:43,509 --> 00:03:41,510
together and so the general principle

81
00:03:46,660 --> 00:03:43,519
here is that you cannot obtain power

82
00:03:50,470 --> 00:03:46,670
continuously from changes in Casimir

83
00:03:52,570 --> 00:03:50,480
cavity spacing let's now take a look at

84
00:03:56,130 --> 00:03:52,580
our third example so our third example

85
00:03:59,530 --> 00:03:56,140
is pumping gas through casimir cavities

86
00:04:02,039 --> 00:03:59,540
there was a patent by two characters

87
00:04:06,100 --> 00:04:02,049
Bernie high-ish and Garrett Modell and

88
00:04:09,539 --> 00:04:06,110

they actually wrote this up in 2005 I

89
00:04:12,130 --> 00:04:09,549
think and the patent was issued in 2008

90
00:04:14,400 --> 00:04:12,140
surprisingly by the way for for our

91
00:04:18,159 --> 00:04:14,410
patent attorney here all of the claims

92
00:04:20,349 --> 00:04:18,169
were accepted by the patent office and

93
00:04:21,699 --> 00:04:20,359
it's called quantum vacuum energy

94
00:04:23,110 --> 00:04:21,709
extraction

95
00:04:25,080 --> 00:04:23,120
and let's take a look at the principal

96
00:04:27,900 --> 00:04:25,090
here it's based on stochastic

97
00:04:31,420 --> 00:04:27,910
electrodynamics according to stochastic

98
00:04:34,860 --> 00:04:31,430
electrodynamics we have atoms and the

99
00:04:38,379 --> 00:04:34,870
atoms have electrons orbiting a nucleus

100
00:04:40,240 --> 00:04:38,389
because the electrons are constantly

101
00:04:42,129 --> 00:04:40,250
oscillating around the nucleus they're

102
00:04:44,589 --> 00:04:42,139
constantly radiating and so there's

103
00:04:47,890 --> 00:04:44,599
constant radiation of energy this

104
00:04:49,570 --> 00:04:47,900
radiation is balanced by incoming

105
00:04:52,300 --> 00:04:49,580
radiation from the zero-point field

106
00:04:54,850 --> 00:04:52,310
that's in the background and so we have

107
00:04:57,879 --> 00:04:54,860
a dynamic equilibrium between incoming

108
00:05:01,210 --> 00:04:57,889
and outgoing energy this is not the

109
00:05:04,600 --> 00:05:01,220
usual way that physics looks at an atom

110
00:05:07,719 --> 00:05:04,610
but it works it's been shown to work as

111
00:05:11,680 --> 00:05:07,729
much accuracy as the traditional quantum

112
00:05:15,399 --> 00:05:11,690
mechanical view that means that if we

113
00:05:18,909 --> 00:05:15,409

take an atom and we put it inside of a

114
00:05:20,529 --> 00:05:18,919
Casimir cavity then in that Casimir

115
00:05:22,749 --> 00:05:20,539
cavity we know that there are going to

116
00:05:25,779 --> 00:05:22,759
be a fewer electromagnetic modes

117
00:05:29,649 --> 00:05:25,789
available and if we tune the cavity

118
00:05:31,689 --> 00:05:29,659
right what we can do is we remove some

119
00:05:34,810 --> 00:05:31,699
of those modes that support the

120
00:05:39,310 --> 00:05:34,820
electronic orbital the end result is

121
00:05:43,990 --> 00:05:39,320
that the electron spins down it spins to

122
00:05:47,680 --> 00:05:44,000
a lower energy and we end up with a

123
00:05:50,469 --> 00:05:47,690
different sort of orbital in within the

124
00:05:53,170 --> 00:05:50,479
Casimir cavity so how is this used to

125
00:05:57,490 --> 00:05:53,180
obtain energy from the vacuum the idea

126
00:06:00,370 --> 00:05:57,500
is pretty simple take gas flow it into

127
00:06:03,969 --> 00:06:00,380
the Casimir cavity as the gas enters the

128
00:06:06,520 --> 00:06:03,979
Casimir cavity energy is emitted shown

129
00:06:09,070 --> 00:06:06,530
by these two blue arrows that excess

130
00:06:11,770 --> 00:06:09,080
energy that's emitted is absorbed you

131
00:06:14,830 --> 00:06:11,780
can absorb it in a detector you can

132
00:06:16,930 --> 00:06:14,840
absorb it in a bath of water and so on

133
00:06:19,300 --> 00:06:16,940
and it's used and that's that's the

134
00:06:23,379 --> 00:06:19,310
energy that we get from the process then

135
00:06:25,420 --> 00:06:23,389
when the gas is continues to flow out of

136
00:06:29,800 --> 00:06:25,430
the Casimir cavity and back into the

137
00:06:31,590 --> 00:06:29,810
ambient universe it's recharged the

138
00:06:34,140 --> 00:06:31,600

electron is recharged

139
00:06:36,360 --> 00:06:34,150
the ambient zero-point energy and goes

140
00:06:38,130 --> 00:06:36,370
back to its initial state then repeat

141
00:06:41,010 --> 00:06:38,140
this process and so you can pump the gas

142
00:06:48,000 --> 00:06:41,020
over and over through the Casimir cavity

143
00:06:50,880 --> 00:06:48,010
and in principle obtain energy so the

144
00:06:52,920 --> 00:06:50,890
idea can be thought of as a heat pump

145
00:06:56,670 --> 00:06:52,930
but for zero point energy where we're

146
00:06:59,730 --> 00:06:56,680
simply pumping energy from one place the

147
00:07:04,830 --> 00:06:59,740
the ambient universe to a local place

148
00:07:08,220 --> 00:07:04,840
our absorber so a question is can we

149
00:07:10,980 --> 00:07:08,230
make this practical and are we

150
00:07:14,310 --> 00:07:10,990
disobeying any fundamental laws so the

151
00:07:18,030 --> 00:07:14,320
initial reaction is wait a minute the

152
00:07:21,510 --> 00:07:18,040
zero-point energy background is uniform

153
00:07:25,050 --> 00:07:21,520
and we've said that it's in equilibrium

154
00:07:26,520 --> 00:07:25,060
how can you obtain energy from a uniform

155
00:07:28,170 --> 00:07:26,530
background imagine that you've got an

156
00:07:30,930 --> 00:07:28,180
ocean that's all the same temperature

157
00:07:33,750 --> 00:07:30,940
and in this ocean you want to make use

158
00:07:35,790 --> 00:07:33,760
of the heat well you can't pump the heat

159
00:07:38,010 --> 00:07:35,800
or allow the heat to flow from one

160
00:07:39,210 --> 00:07:38,020
region to another region and use it

161
00:07:41,250 --> 00:07:39,220
because the temperature is the same

162
00:07:43,290 --> 00:07:41,260
everywhere so isn't that going to be the

163
00:07:45,240 --> 00:07:43,300

same with the zero-point energy and

164
00:07:47,700 --> 00:07:45,250
aren't you going to end up with the same

165
00:07:49,830 --> 00:07:47,710
sort of problem and not be able to use

166
00:07:54,630 --> 00:07:49,840
the energy well the answer is actually

167
00:07:57,000 --> 00:07:54,640
no because the vacuum state changes with

168
00:07:59,220 --> 00:07:57,010
boundary conditions it's not uniform

169
00:08:01,110 --> 00:07:59,230
everywhere we can change the ground

170
00:08:03,840 --> 00:08:01,120
level and that is if we have a Casimir

171
00:08:06,090 --> 00:08:03,850
cavity within that geometrical

172
00:08:09,690 --> 00:08:06,100
geometrically constrained region we've

173
00:08:12,000 --> 00:08:09,700
got a lower ground energy level and so

174
00:08:14,190 --> 00:08:12,010
we actually do have multiple levels

175
00:08:17,340 --> 00:08:14,200
which allow energy to flow from one

176
00:08:22,140 --> 00:08:17,350
level to another so we're not being

177
00:08:24,830 --> 00:08:22,150
constrained by the the fact that that

178
00:08:27,960 --> 00:08:24,840
zero-point energy is at equilibrium

179
00:08:34,680 --> 00:08:27,970
similarly were not being constrained by

180
00:08:36,060 --> 00:08:34,690
the fact that that we need to that the

181
00:08:38,310 --> 00:08:36,070
zero-point energy is a conservative

182
00:08:41,130 --> 00:08:38,320
force because we're not using any sort

183
00:08:42,780 --> 00:08:41,140
of mechanical process moving Casimir

184
00:08:46,830 --> 00:08:42,790
cavity plates

185
00:08:49,140 --> 00:08:46,840
two flaws in the previous two types of

186
00:08:54,540 --> 00:08:49,150
zero point energy extraction methods I

187
00:08:57,390 --> 00:08:54,550
believe do not apply to this so is it

188
00:08:59,640 --> 00:08:57,400

practical I did some calculations based

189
00:09:03,180 --> 00:08:59,650
on how much energy we think is going to

190
00:09:05,340 --> 00:09:03,190
be emitted from each atomic transition

191
00:09:07,290 --> 00:09:05,350
as it goes through the Casimir cavity

192
00:09:09,690 --> 00:09:07,300
and what we need is about ten to the

193
00:09:14,420 --> 00:09:09,700
twenty two transitions per second to get

194
00:09:17,970 --> 00:09:14,430
a kilowatt you can do that in a stack of

195
00:09:21,480 --> 00:09:17,980
of cds for example about 20 cds that's

196
00:09:24,920 --> 00:09:21,490
about this big and you can then allow

197
00:09:27,930 --> 00:09:24,930
and pump the gas through this and

198
00:09:30,600 --> 00:09:27,940
continuously radiate about a kilowatt of

199
00:09:33,680 --> 00:09:30,610
zero point energy it takes if you do a

200
00:09:37,680 --> 00:09:33,690
calculation about point four wats to

201
00:09:40,260 --> 00:09:37,690
carry out the pumping and so the energy

202
00:09:42,780 --> 00:09:40,270
out is at least a factor of a thousand

203
00:09:47,940 --> 00:09:42,790
greater than the energy in so in

204
00:09:50,850 --> 00:09:47,950
principle this should work is there

205
00:09:53,280 --> 00:09:50,860
another flaw an underlying principle

206
00:09:56,400 --> 00:09:53,290
that we're breaking here that says that