



1
00:00:06,860 --> 00:00:05,269
that word in laser pointer gutter okay

2
00:00:10,720 --> 00:00:06,870
thank you very much I appreciate this

3
00:00:13,850 --> 00:00:10,730
opportunity to be here so it's nice and

4
00:00:15,200 --> 00:00:13,860
the good news is that my mathematics is

5
00:00:18,080 --> 00:00:15,210
not quite as tough as some of them them

6
00:00:20,870 --> 00:00:18,090
before so that may be good or bad news i

7
00:00:23,390 --> 00:00:20,880
don't know which i've started out kind

8
00:00:26,480 --> 00:00:23,400
of strangely in a way because this ye

9
00:00:31,460 --> 00:00:26,490
yang symbol so to speak it's a satellite

10
00:00:33,380 --> 00:00:31,470
of Saturn it's the moon I artists it has

11
00:00:35,510 --> 00:00:33,390
one side which is all mostly right and

12
00:00:37,729 --> 00:00:35,520
one side which is basically black which

13
00:00:39,889 --> 00:00:37,739

is kind of unusual it's really the only

14

00:00:42,170 --> 00:00:39,899

place in the solar system like that this

15

00:00:46,130 --> 00:00:42,180

is a somewhat better shot of it closer

16

00:00:47,900 --> 00:00:46,140

up thanks to Cassini and looks kind of

17

00:00:49,520 --> 00:00:47,910

normal in some respects except for sort

18

00:00:54,290 --> 00:00:49,530

of a little Ridge runnin around there

19

00:00:57,319 --> 00:00:54,300

which as it turns out shown here this

20

00:01:00,760 --> 00:00:57,329

Ridge is a well if it were on earth on a

21

00:01:02,990 --> 00:01:00,770

relative basis it would be 60 miles high

22

00:01:06,070 --> 00:01:03,000

because all the way around the planet

23

00:01:08,450 --> 00:01:06,080

excuse me all the way around the moon

24

00:01:10,310 --> 00:01:08,460

this is extremely strange this doesn't

25

00:01:12,740 --> 00:01:10,320

like it and there's been some attempts

26

00:01:15,679 --> 00:01:12,750

to explain it but it doesn't get

27

00:01:17,600 --> 00:01:15,689

explained too well nor does the black

28

00:01:20,120 --> 00:01:17,610

white get explained to well we just

29

00:01:21,980 --> 00:01:20,130

can't quite figure that one out but of

30

00:01:24,560 --> 00:01:21,990

course all of them are running around

31

00:01:28,580 --> 00:01:24,570

the planet Saturn now as it turns out

32

00:01:31,100 --> 00:01:28,590

most of the moons of Saturn are based on

33

00:01:32,660 --> 00:01:31,110

the same plane as the Rings and so

34

00:01:34,149 --> 00:01:32,670

really if you're one of these are the

35

00:01:36,950 --> 00:01:34,159

millions you can't see anything you

36

00:01:38,780 --> 00:01:36,960

can't see the ring just kind of a thick

37

00:01:40,749 --> 00:01:38,790

line maybe maybe you got a shadow on the

38

00:01:44,660 --> 00:01:40,759

planet occasionally but that's about it

39

00:01:48,649 --> 00:01:44,670

but I epic taste is a little different

40

00:01:50,210 --> 00:01:48,659

you can see that the side and with all

41

00:01:52,580 --> 00:01:50,220

the other moons on the Rings are right

42

00:01:55,760 --> 00:01:52,590

in here and then I epochs is doing this

43

00:01:57,709 --> 00:01:55,770

really nice ellipsoid here it's about

44

00:02:01,359 --> 00:01:57,719

900 miles across and it's got a few

45

00:02:04,039 --> 00:02:01,369

things it's really very few few

46

00:02:07,110 --> 00:02:04,049

satellites that has a shall we say a

47

00:02:08,760 --> 00:02:07,120

moon with a view and it really gets to

48

00:02:10,830 --> 00:02:08,770

saturn and you don't get to do it

49

00:02:12,240 --> 00:02:10,840

otherwise and in fact the moon with the

50

00:02:14,580 --> 00:02:12,250

view is a good place to go if you are

51
00:02:16,440 --> 00:02:14,590
interested in doing this and looking in

52
00:02:18,840 --> 00:02:16,450
this photos by Richard Hoagland some

53
00:02:21,320 --> 00:02:18,850
other things and it's really pretty

54
00:02:25,680 --> 00:02:21,330
fascinating and a lot of respects I

55
00:02:28,200 --> 00:02:25,690
mentioned it at this point because from

56
00:02:29,520 --> 00:02:28,210
my viewpoint is do it's my motivation in

57
00:02:32,120 --> 00:02:29,530
the way for the one of some of the

58
00:02:34,710 --> 00:02:32,130
things I'm talking about doing and that

59
00:02:37,350 --> 00:02:34,720
the whole idea of this talk is that one

60
00:02:39,720 --> 00:02:37,360
if I wanted to go to Saturn 1 i'm going

61
00:02:41,580 --> 00:02:39,730
to need a good propulsion system not a

62
00:02:43,500 --> 00:02:41,590
word drive necessarily like that because

63
00:02:45,420 --> 00:02:43,510

let's face it if you had work blood

64

00:02:47,220 --> 00:02:45,430

there'd be some rules saying you can't

65

00:02:48,930 --> 00:02:47,230

do it inside the orbit of Saturn or

66

00:02:51,840 --> 00:02:48,940

something like that you know you you

67

00:02:55,920 --> 00:02:51,850

know it did cause too much no it just to

68

00:02:58,170 --> 00:02:55,930

be terrible but anyway so also need an

69

00:02:59,580 --> 00:02:58,180

energy source to get there too and so

70

00:03:00,930 --> 00:02:59,590

we're going to a little of a segue here

71

00:03:02,760 --> 00:03:00,940

we're going to talk about propulsion and

72

00:03:05,840 --> 00:03:02,770

we're going to talk about in going into

73

00:03:08,700 --> 00:03:05,850

the developing some energy from all this

74

00:03:10,800 --> 00:03:08,710

now the what I want to start with this

75

00:03:12,810 --> 00:03:10,810

in terms of propulsion is Newton's third

76

00:03:16,110 --> 00:03:12,820

law which is for every action there is

77

00:03:17,520 --> 00:03:16,120

an equal and opposite reaction now equal

78

00:03:19,020 --> 00:03:17,530

and opposite is probably to be

79

00:03:21,780 --> 00:03:19,030

emphasized because the equal and

80

00:03:23,640 --> 00:03:21,790

opposite is a conservation that's right

81

00:03:25,590 --> 00:03:23,650

if you push against something then we

82

00:03:27,990 --> 00:03:25,600

got to have the same lot of push going

83

00:03:30,810 --> 00:03:28,000

the other way otherwise it does you know

84

00:03:35,130 --> 00:03:30,820

something wrong but maybe maybe that's

85

00:03:36,780 --> 00:03:35,140

not quite right for example anytime you

86

00:03:38,850 --> 00:03:36,790

have a conservation law you have to kind

87

00:03:41,430 --> 00:03:38,860

of look at all the assumptions that it

88

00:03:44,610 --> 00:03:41,440

makes this one makes for example assumes

89

00:03:48,690 --> 00:03:44,620

a point mass it assumes actionable the

90

00:03:50,280 --> 00:03:48,700

entire body simultaneously we also know

91

00:03:51,930 --> 00:03:50,290

in general in terms of mechanics that

92

00:03:54,060 --> 00:03:51,940

the mass is usually concentrated at the

93

00:03:55,500 --> 00:03:54,070

center of gravity things act as if

94

00:03:58,620 --> 00:03:55,510

they're operating from the center of

95

00:04:00,650 --> 00:03:58,630

gravity some of these assumptions are

96

00:04:04,040 --> 00:04:00,660

essentially assumption of simultaneity

97

00:04:06,570 --> 00:04:04,050

order you're pushing everything at once

98

00:04:08,490 --> 00:04:06,580

there also is a similar action upon a

99

00:04:10,710 --> 00:04:08,500

rigid body which doesn't work if you're

100

00:04:12,390 --> 00:04:10,720

dealing with jello jello is not

101

00:04:15,230 --> 00:04:12,400

generally used in most of these talks

102

00:04:18,320 --> 00:04:15,240

but in fact it's it does so

103

00:04:21,020 --> 00:04:18,330

purpose one of the things that all these

104

00:04:24,230 --> 00:04:21,030

laws Newtonian mechanics in particular

105

00:04:26,420 --> 00:04:24,240

it still works you know those mechanics

106

00:04:28,640 --> 00:04:26,430

it does work when you get into very high

107

00:04:31,010 --> 00:04:28,650

velocities like approaching the speed of

108

00:04:34,550 --> 00:04:31,020

light hey great you're gonna have to

109

00:04:36,560 --> 00:04:34,560

make some changes but Einstein really

110

00:04:38,750 --> 00:04:36,570

just extended Newtonian mechanics and to

111

00:04:41,150 --> 00:04:38,760

certain realms and I want to suggest

112

00:04:43,760 --> 00:04:41,160

today that one of the realms will need

113

00:04:46,790 --> 00:04:43,770

to extend it into is extremely seller

114

00:04:50,270 --> 00:04:46,800

Asians not only extremely celebrations

115

00:04:52,370 --> 00:04:50,280

but extreme changes in acceleration

116

00:04:58,670 --> 00:04:52,380

which is what I'm talking about in terms

117

00:05:00,470 --> 00:04:58,680

of a radical change of pace the basic

118

00:05:02,570 --> 00:05:00,480

concept we're trying to generate here is

119

00:05:05,180 --> 00:05:02,580

that if you have an initiating force

120

00:05:09,460 --> 00:05:05,190

applied to an object and it takes some

121

00:05:12,410 --> 00:05:09,470

time before that object can absorb an

122

00:05:14,360 --> 00:05:12,420

equal and opposite reaction then the

123

00:05:16,310 --> 00:05:14,370

initiating force the prime mover if you

124

00:05:21,380 --> 00:05:16,320

want to call it can retract an ability

125

00:05:23,810 --> 00:05:21,390

reaction the slide that story just

126

00:05:25,370 --> 00:05:23,820

showed it was great I loved it where it

127

00:05:26,840 --> 00:05:25,380

shows one last kind of bumping into the

128

00:05:29,030 --> 00:05:26,850

mass and it just moves it all the way

129

00:05:30,860 --> 00:05:29,040

down the right that's kind of what we're

130

00:05:32,990 --> 00:05:30,870

talking about except here you're pushing

131

00:05:35,000 --> 00:05:33,000

against this mess and then you go and

132

00:05:38,180 --> 00:05:35,010

then you get away from it before has a

133

00:05:40,280 --> 00:05:38,190

chance to react it's almost like you

134

00:05:41,720 --> 00:05:40,290

want to rob a bank you can do it you

135

00:05:44,440 --> 00:05:41,730

just have to get out of a system before

136

00:05:46,610 --> 00:05:44,450

they catch you so if you're really quick

137

00:05:48,410 --> 00:05:46,620

you're doing it you get the money and

138

00:05:49,790 --> 00:05:48,420

you leave and of course the system of

139

00:05:52,490 --> 00:05:49,800

course has to be the whole country since

140

00:05:54,230 --> 00:05:52,500

there's law enforcement thanks of that

141

00:05:58,820 --> 00:05:54,240

nature but if you can get in and out it

142

00:06:00,650 --> 00:05:58,830

works lilo Davis said many years ago you

143

00:06:02,360 --> 00:06:00,660

can get away with anything just as long

144

00:06:04,760 --> 00:06:02,370

as you're outside the system before it

145

00:06:06,470 --> 00:06:04,770

can react and I think that's kind of a

146

00:06:08,810 --> 00:06:06,480

name of the game and that's where the

147

00:06:10,790 --> 00:06:08,820

propulsion idea comes from that we push

148

00:06:12,920 --> 00:06:10,800

against something and we get all the way

149

00:06:15,050 --> 00:06:12,930

before it happens you can make push it

150

00:06:16,670 --> 00:06:15,060

again just it gets a little confused

151
00:06:18,320 --> 00:06:16,680
because it keeps getting pushed and get

152
00:06:23,770 --> 00:06:18,330
signals in there but then before it can

153
00:06:29,050 --> 00:06:26,230
what we've done here this is the mission

154
00:06:32,080 --> 00:06:29,060
the top equation is one that really was

155
00:06:33,700 --> 00:06:32,090
actually started up with you have our

156
00:06:37,810 --> 00:06:33,710
classical mechanics all these various

157
00:06:42,010 --> 00:06:37,820
things oops excuse me wrong button this

158
00:06:45,430 --> 00:06:42,020
position the viscosity this is base your

159
00:06:49,090 --> 00:06:45,440
resistance term this is the mass emek ma

160
00:06:51,430 --> 00:06:49,100
equals F F equals MA excuse me and this

161
00:06:52,840 --> 00:06:51,440
is the third derivative the third

162
00:06:55,030 --> 00:06:52,850
derivative sought we're not really using

163
00:06:57,640 --> 00:06:55,040

we used to force capacitance resistance

164

00:06:59,530 --> 00:06:57,650

inertia whatever but not so much a third

165

00:07:01,900 --> 00:06:59,540

derivative it's that third derivative

166

00:07:03,580 --> 00:07:01,910

that really counts it's curious that the

167

00:07:06,100 --> 00:07:03,590

right to a certain has the same kind of

168

00:07:09,040 --> 00:07:06,110

form of an equation there is an

169

00:07:10,330 --> 00:07:09,050

assumption here of these two items here

170

00:07:13,210 --> 00:07:10,340

which may be something altogether

171

00:07:14,620 --> 00:07:13,220

different and right now this is

172

00:07:16,960 --> 00:07:14,630

basically a constant and this would be a

173

00:07:18,790 --> 00:07:16,970

mass but that might not be the same and

174

00:07:22,150 --> 00:07:18,800

it does not actually required to be done

175

00:07:25,000 --> 00:07:22,160

that way this is actually a solution on

176

00:07:29,500 --> 00:07:25,010

I'm put this up and primarily because to

177

00:07:32,290 --> 00:07:29,510

point out to point out the denominator

178

00:07:34,440 --> 00:07:32,300

this term here which is the capacitance

179

00:07:36,790 --> 00:07:34,450

excuse me inductance capacitance

180

00:07:41,920 --> 00:07:36,800

resistance term and then this other term

181

00:07:44,020 --> 00:07:41,930

right here now you can get and in terms

182

00:07:46,240 --> 00:07:44,030

of if you're trying to get something

183

00:07:50,050 --> 00:07:46,250

really good at a dominate you you didn't

184

00:07:51,130 --> 00:07:50,060

go to 0 this term here could go to 0 you

185

00:07:52,990 --> 00:07:51,140

could have the inductance and

186

00:07:57,400 --> 00:07:53,000

capacitance at some point basically

187

00:08:00,190 --> 00:07:57,410

matched here if you didn't have this

188

00:08:01,930 --> 00:08:00,200

Trump f0 you always have R square it's

189

00:08:04,900 --> 00:08:01,940

always going to be something you may get

190

00:08:08,230 --> 00:08:04,910

some reduced resistance in the in terms

191

00:08:12,610 --> 00:08:08,240

of superconductivity but not it's not

192

00:08:15,670 --> 00:08:12,620

going to 0 here though theoretically you

193

00:08:19,570 --> 00:08:15,680

can and so you could have a position for

194

00:08:24,620 --> 00:08:19,580

suddenly this thing goes to 0 and the

195

00:08:31,640 --> 00:08:27,950

this shows kind of going over into power

196

00:08:33,830 --> 00:08:31,650

now or energy and and we get the same

197

00:08:38,990 --> 00:08:33,840

kinds of equations everything is pretty

198

00:08:41,360 --> 00:08:39,000

much the same excuse me again this is

199

00:08:43,250 --> 00:08:41,370

based on charge here but you can also do

200

00:08:44,600 --> 00:08:43,260

it in terms of well you can do it in

201
00:08:47,150 --> 00:08:44,610
terms of current so it's slightly

202
00:08:49,510 --> 00:08:47,160
different but I prefer to use this we're

203
00:08:52,340 --> 00:08:49,520
going to keep referring this to this

204
00:08:56,870 --> 00:08:52,350
third derivative as being the important

205
00:08:58,130 --> 00:08:56,880
thing if you solve the equation one of

206
00:09:00,800 --> 00:08:58,140
the things that happens here is that

207
00:09:02,120 --> 00:09:00,810
well this is just a rate of at which

208
00:09:05,150 --> 00:09:02,130
energy is delivered to the circuit

209
00:09:07,760 --> 00:09:05,160
that's your input this is the

210
00:09:11,000 --> 00:09:07,770
capacitance this is the inductance terms

211
00:09:14,600 --> 00:09:11,010
they're pretty much the same except

212
00:09:16,400 --> 00:09:14,610
especially with this sign turn and that

213
00:09:18,320 --> 00:09:16,410

sine term can go back and forth you can

214

00:09:22,430 --> 00:09:18,330

get a plus or minus with a sign of any

215

00:09:24,470 --> 00:09:22,440

angle okay so those two go back and

216

00:09:26,960 --> 00:09:24,480

forth they simply just rotate around

217

00:09:29,000 --> 00:09:26,970

each other if you will it's the same

218

00:09:31,670 --> 00:09:29,010

thing on a pendulum you have potential

219

00:09:33,080 --> 00:09:31,680

energy of a potential but no kinetic may

220

00:09:34,810 --> 00:09:33,090

comes rolling down and you lose

221

00:09:36,830 --> 00:09:34,820

potential energy and it goes into

222

00:09:40,580 --> 00:09:36,840

kinetic energy which is the same

223

00:09:45,730 --> 00:09:40,590

basically concept you're doing here the

224

00:09:48,530 --> 00:09:45,740

perm forum excuse me again the term for

225

00:09:52,010 --> 00:09:48,540

the resistance i squared our heating if

226

00:09:55,730 --> 00:09:52,020

you will is it's a sine squared bill so

227

00:09:58,490 --> 00:09:55,740

in this term it doesn't switch science

228

00:10:01,040 --> 00:09:58,500

your resistance is always going to take

229

00:10:06,440 --> 00:10:01,050

energy from the system and deliver to

230

00:10:09,440 --> 00:10:06,450

the universe some part okay well it's to

231

00:10:12,800 --> 00:10:09,450

the term it matches it is the term we've

232

00:10:15,650 --> 00:10:12,810

added here the this would be the third

233

00:10:18,530 --> 00:10:15,660

derivative the charge same thing but

234

00:10:20,570 --> 00:10:18,540

it's the opposite sign so this third

235

00:10:23,780 --> 00:10:20,580

term is basically saying this is the

236

00:10:24,450 --> 00:10:23,790

energy whoops again thank you this is

237

00:10:28,830 --> 00:10:24,460

energy

238

00:10:32,040 --> 00:10:28,840

n by the universe into the system

239

00:10:33,450 --> 00:10:32,050

scoring the other direction and I don't

240

00:10:37,380 --> 00:10:33,460

have as much time this is a power ratio

241

00:10:40,440 --> 00:10:37,390

which says is sort of the same thing if

242

00:10:42,180 --> 00:10:40,450

this was zero it would be just this is

243

00:10:44,190 --> 00:10:42,190

why you don't get over unity because

244

00:10:46,380 --> 00:10:44,200

there's always some losses here this is

245

00:10:48,780 --> 00:10:46,390

always a positive number and the oils

246

00:10:52,170 --> 00:10:48,790

gonna have losses but if you don't you

247

00:10:56,630 --> 00:10:52,180

do something altogether different now

248

00:11:01,590 --> 00:10:59,910

this term here this is kind of your

249

00:11:03,240 --> 00:11:01,600

mainstream physics this is what we've

250

00:11:04,710 --> 00:11:03,250

always been operating with this is what

251
00:11:07,350 --> 00:11:04,720
everything is kind of beige stone-built

252
00:11:09,330 --> 00:11:07,360
own but what we want to do is go to this

253
00:11:14,700 --> 00:11:09,340
term here and try to make something of

254
00:11:16,230 --> 00:11:14,710
it now this is a quote by Arthur Young

255
00:11:18,630 --> 00:11:16,240
who got into this third derivative

256
00:11:20,280 --> 00:11:18,640
aspect he said the science is based on

257
00:11:22,830 --> 00:11:20,290
the derivatives discovered by believe

258
00:11:24,150 --> 00:11:22,840
Justin Newton I like the fact he keeps

259
00:11:26,160 --> 00:11:24,160
leading us in there as well as Newton

260
00:11:28,740 --> 00:11:26,170
the derivatives are rates of change

261
00:11:30,960 --> 00:11:28,750
first really change position velocity

262
00:11:33,390 --> 00:11:30,970
the second derivatives the acceleration

263
00:11:36,090 --> 00:11:33,400

the third derivative is a change of

264

00:11:38,280 --> 00:11:36,100

acceleration of acceleration of current

265

00:11:41,400 --> 00:11:38,290

either one that's always ignored by

266

00:11:43,460 --> 00:11:41,410

science but it is because we can change

267

00:11:45,720 --> 00:11:43,470

the acceleration that we can drive a car

268

00:11:47,280 --> 00:11:45,730

in a few did you couldn't stop you need

269

00:11:48,930 --> 00:11:47,290

officially accelerator and couldn't

270

00:11:51,840 --> 00:11:48,940

change that you're not doing somewhat

271

00:11:55,860 --> 00:11:51,850

trouble and this is basically through

272

00:11:58,590 --> 00:11:55,870

the idea it is through control we use

273

00:11:59,970 --> 00:11:58,600

the laws of determinism the control is a

274

00:12:02,310 --> 00:11:59,980

principle which makes it possible for

275

00:12:04,830 --> 00:12:02,320

life in similar fashion to use the laws

276

00:12:07,400 --> 00:12:04,840

of determination to control metabolism

277

00:12:09,930 --> 00:12:07,410

to store energy and move against entropy

278

00:12:13,020 --> 00:12:09,940

this is the theory process that author

279

00:12:17,490 --> 00:12:13,030

young put out and I emphasize it because

280

00:12:19,410 --> 00:12:17,500

it's got the it's got this zero first

281

00:12:21,500 --> 00:12:19,420

second and third derivatives the first

282

00:12:24,810 --> 00:12:21,510

is what he called unconscious action and

283

00:12:27,810 --> 00:12:24,820

then the second unconscious reaction and

284

00:12:31,380 --> 00:12:27,820

then conscious reaction these three

285

00:12:34,020 --> 00:12:31,390

again are the determinism this is why in

286

00:12:36,260 --> 00:12:34,030

physics if you look at the hard core

287

00:12:38,780 --> 00:12:36,270

physics in the way everything

288

00:12:39,920 --> 00:12:38,790

determined it's just a clock we're just

289

00:12:41,420 --> 00:12:39,930

running along we're just trying to get

290

00:12:45,290 --> 00:12:41,430

all the details but nothing can only be

291

00:12:47,240 --> 00:12:45,300

added or taken away but when you go into

292

00:12:50,330 --> 00:12:47,250

the third derivative this control it's

293

00:12:52,130 --> 00:12:50,340

conscious action you change something so

294

00:12:53,600 --> 00:12:52,140

there's even a certain sense that

295

00:12:55,220 --> 00:12:53,610

something you have to think about

296

00:12:57,860 --> 00:12:55,230

consciousness which other they would

297

00:13:03,320 --> 00:12:57,870

probably rather not think about not in

298

00:13:05,120 --> 00:13:03,330

physics is too hard to deal with what i

299

00:13:06,440 --> 00:13:05,130

am trying to send it's very very brief

300

00:13:10,070 --> 00:13:06,450

thing because I'm just about out of time

301
00:13:13,420 --> 00:13:10,080
the universe always contributes a steady

302
00:13:16,250 --> 00:13:13,430
state the contribution is probably

303
00:13:18,530 --> 00:13:16,260
minuscule it simply wouldn't show up on

304
00:13:20,780 --> 00:13:18,540
anything transient conditions you have

305
00:13:22,040 --> 00:13:20,790
greater University contribution one of

306
00:13:25,490 --> 00:13:22,050
the things that people have noticed in

307
00:13:27,410 --> 00:13:25,500
mechanical engineering is that if you

308
00:13:29,240 --> 00:13:27,420
turn it on some it you know motors use

309
00:13:31,550 --> 00:13:29,250
first when you first apply it you get

310
00:13:34,160 --> 00:13:31,560
this transient condition and before you

311
00:13:36,500 --> 00:13:34,170
know it they just takes off and it's

312
00:13:39,080 --> 00:13:36,510
goes berserk goes up some case so

313
00:13:41,240 --> 00:13:39,090

literally comes apart that trend they

314

00:13:43,850 --> 00:13:41,250

have to spend a lot of time to make sure

315

00:13:45,560 --> 00:13:43,860

the transients don't get out of hand but

316

00:13:48,440 --> 00:13:45,570

the transient condition is the deal is

317

00:13:49,400 --> 00:13:48,450

the change and the greater the change

318

00:13:52,130 --> 00:13:49,410

the grid of the universe its

319

00:13:55,820 --> 00:13:52,140

contribution the greater the rate of

320

00:13:59,080 --> 00:13:55,830

change the system there's a system delay

321

00:14:02,300 --> 00:13:59,090

if I if I like I'm pushing against this

322

00:14:04,370 --> 00:14:02,310

register here there's a message goes

323

00:14:07,250 --> 00:14:04,380

from here into the center of gravity

324

00:14:09,110 --> 00:14:07,260

that comes back just push back but a bit

325

00:14:10,880 --> 00:14:09,120

real quick it won't have a chance and

326

00:14:13,310 --> 00:14:10,890

this time delay is the name of

327

00:14:14,870 --> 00:14:13,320

everything this whole thing actually

328

00:14:16,370 --> 00:14:14,880

gets shown up a little bit in something

329

00:14:19,270 --> 00:14:16,380

called sonoluminescence supposed to be

330

00:14:22,460 --> 00:14:19,280

you're probably familiar with and the

331

00:14:25,130 --> 00:14:22,470

this case this is an ideal place to kind

332

00:14:27,940 --> 00:14:25,140

of look for a little bit because the

333

00:14:31,130 --> 00:14:27,950

you're growing from a acceleration

334

00:14:33,770 --> 00:14:31,140

billions of times the acceleration of

335

00:14:36,680 --> 00:14:33,780

gravity to zero acceleration in going

336

00:14:38,660 --> 00:14:36,690

the other direction and obviously a rate

337

00:14:41,510 --> 00:14:38,670

of change of acceleration is enormous

338

00:14:43,250 --> 00:14:41,520

and then you put the sum of the numbers

339

00:14:45,860 --> 00:14:43,260

to it it comes out you start getting

340

00:14:47,290 --> 00:14:45,870

what's out of this contribution and it's

341

00:14:49,570 --> 00:14:47,300

so it's not told ians

342

00:14:54,820 --> 00:14:49,580

and that's being fairly conservative in

343

00:14:56,650 --> 00:14:54,830

terms of your assumptions the big key of

344

00:14:58,570 --> 00:14:56,660

course is that time to let big number

345

00:15:02,590 --> 00:14:58,580

which in this case was either the Dior

346

00:15:04,360 --> 00:15:02,600

the W so that the that's what makes it

347

00:15:08,680 --> 00:15:04,370

but you still need local energy in the

348

00:15:13,930 --> 00:15:08,690

system to initiate the reaction okay

349

00:15:24,400 --> 00:15:13,940

that's I'm all out of time ok so if any

350

00:15:26,079 --> 00:15:24,410

questions our speaker ended right on

351

00:15:30,040 --> 00:15:26,089

time so we have about five minutes for

352

00:15:31,150 --> 00:15:30,050

questions ok Bernie's closest so I'm

353

00:15:34,300 --> 00:15:31,160

just curious what does this have to do

354

00:15:35,889 --> 00:15:34,310

with the moon your Paytas and secondly I

355

00:15:39,430 --> 00:15:35,899

didn't hear the first of all this have

356

00:15:41,350 --> 00:15:39,440

to do with the moon oh it is we the moon

357

00:15:43,360 --> 00:15:41,360

in the sense of I'm just want to go

358

00:15:45,490 --> 00:15:43,370

there we need a manned space mission to

359

00:15:47,769 --> 00:15:45,500

go there so no I don't know where it

360

00:15:48,940 --> 00:15:47,779

comes from no stone question of course

361

00:15:50,530 --> 00:15:48,950

you keep going to higher and higher

362

00:15:53,230 --> 00:15:50,540

derivatives why stop at three why not

363

00:15:55,510 --> 00:15:53,240

four or five six be if you do the fourth

364

00:15:56,920 --> 00:15:55,520

derivative is a good question i like it

365

00:15:58,540 --> 00:15:56,930

i say it's good question because i

366

00:16:01,090 --> 00:15:58,550

actually thought about it before and i

367

00:16:02,680 --> 00:16:01,100

have an answer but if you actually do

368

00:16:04,630 --> 00:16:02,690

the mathematics the fourth derivative

369

00:16:07,389 --> 00:16:04,640

the form of the fourth year we turns out

370

00:16:08,860 --> 00:16:07,399

to be the same as the 0th derivative the

371

00:16:11,350 --> 00:16:08,870

fifth is the same as the first

372

00:16:14,680 --> 00:16:11,360

derivative and there's the difference is

373

00:16:16,690 --> 00:16:14,690

a frequency to the fourth power so it's

374

00:16:19,030 --> 00:16:16,700

like there and i think of it as kind of

375

00:16:21,610 --> 00:16:19,040

a resonance or harmonic maybe that's a

376

00:16:24,519 --> 00:16:21,620

better term of the 0th rivet of the

377

00:16:25,900 --> 00:16:24,529

fifth is on the floor excuse me so it

378

00:16:34,160 --> 00:16:25,910

just it works out that way in the

379

00:16:37,889 --> 00:16:36,150

okay then we got to have one over there

380

00:16:42,389 --> 00:16:37,899

next because I want to see them run back

381

00:16:44,460 --> 00:16:42,399

and there I was just kind of wondering

382

00:16:46,470 --> 00:16:44,470

you said you have to push very quickly

383

00:16:49,519 --> 00:16:46,480

do you have an order of magnitude on how

384

00:16:52,290 --> 00:16:49,529

quick you push before it reacts the

385

00:16:54,150 --> 00:16:52,300

Summoner luminescence as it is to an

386

00:16:56,670 --> 00:16:54,160

example at least we have something to do

387

00:16:59,759 --> 00:16:56,680

with about twenty-five thousand cycles

388

00:17:02,340 --> 00:16:59,769

per second so it's a pretty good size

389

00:17:03,840 --> 00:17:02,350

number if you apply the numbers it it

390

00:17:06,150 --> 00:17:03,850

does require some pretty high

391

00:17:11,880 --> 00:17:06,160

frequencies which means we may be

392

00:17:15,120 --> 00:17:11,890

limited in some fashion by technology

393

00:17:18,480 --> 00:17:15,130

but it's not it's not limited in

394

00:17:21,120 --> 00:17:18,490

principle so so but I have seen other

395

00:17:22,319 --> 00:17:21,130

things too that this is not completely

396

00:17:24,720 --> 00:17:22,329

part of it it's also part of the

397

00:17:28,319 --> 00:17:24,730

situation if you've got even any kind of

398

00:17:29,370 --> 00:17:28,329

reaction to this or that you do you

399

00:17:31,580 --> 00:17:29,380

would sort of prove that the law of

400

00:17:34,799 --> 00:17:31,590

conservation of energy is somewhat

401

00:17:36,090 --> 00:17:34,809

lacking my own feeling is the

402

00:17:38,580 --> 00:17:36,100

conservation of energy is kind of a

403

00:17:41,520 --> 00:17:38,590

bookkeeping that's what we'd use it for

404

00:17:43,500 --> 00:17:41,530

but there's round off error you know you

405

00:17:45,330 --> 00:17:43,510

now you know if it's only 49 cents we're

406

00:17:47,400 --> 00:17:45,340

not going to count it as a dollar and so

407

00:17:53,669 --> 00:17:47,410

forth so that helps I think a little bit

408

00:17:58,710 --> 00:17:53,679

there another question you talked about

409

00:18:01,860 --> 00:17:58,720

that the transients I remember was some

410

00:18:03,990 --> 00:18:01,870

consulting i was doing we had a 700

411

00:18:07,350 --> 00:18:04,000

horsepower electric motor that was not

412

00:18:09,870 --> 00:18:07,360

induction and we had to tell Kansas

413

00:18:11,490 --> 00:18:09,880

power in like 20 minutes before we

414

00:18:17,490 --> 00:18:11,500

pushed the start button otherwise it

415

00:18:21,659 --> 00:18:17,500

would bring down the hole 0 Kansas do

416

00:18:23,040 --> 00:18:21,669

you consider the impact load when you

417

00:18:26,760 --> 00:18:23,050

talk about transiency talking about

418

00:18:29,070 --> 00:18:26,770

impact load or is it out or do you

419

00:18:31,169 --> 00:18:29,080

include the impact of when you first

420

00:18:34,560 --> 00:18:31,179

start something because there is an

421

00:18:37,169 --> 00:18:34,570

impact Liz it is greater than than the

422

00:18:39,480 --> 00:18:37,179

normal load yeah I think that's actually

423

00:18:43,990 --> 00:18:39,490

part of what it is I think it's if you

424

00:18:46,810 --> 00:18:44,000

you include that startup impact

425

00:18:48,010 --> 00:18:46,820

really that transient area the whole lot

426

00:18:50,260 --> 00:18:48,020

of things are possible that weren't

427

00:18:53,940 --> 00:18:50,270

possible at all before and that's really

428

00:18:58,480 --> 00:18:53,950

far basically agreeing with you on that

429

00:19:00,580 --> 00:18:58,490

other questions can't say no since we

430

00:19:03,310 --> 00:19:00,590

have a a moment or two before I need to

431

00:19:06,520 --> 00:19:03,320

cut this off I will comment that the

432

00:19:10,780 --> 00:19:06,530

reason third derivatives are ignored at

433

00:19:12,670 --> 00:19:10,790

least in dynamical laws for moving

434

00:19:16,390 --> 00:19:12,680

objects is simply that when you work out

435

00:19:18,250 --> 00:19:16,400

the laws of motion uh they only go as

436

00:19:21,160 --> 00:19:18,260

high as the second derivative there's

437

00:19:24,100 --> 00:19:21,170

nothing further going on third

438

00:19:25,810 --> 00:19:24,110

derivatives can appear in in physical

439

00:19:28,810 --> 00:19:25,820

systems when there's where there's some

440

00:19:32,350 --> 00:19:28,820

activities such as a rigid objects

441

00:19:35,860 --> 00:19:32,360

colliding on but those don't emerge from

442

00:19:39,690 --> 00:19:35,870

the fundamental dynamics well I would

443

00:19:42,520 --> 00:19:39,700

say that if you go in and you go to

444

00:19:46,140 --> 00:19:42,530

questions and you assume for example a

445

00:19:47,920 --> 00:19:46,150

continuous space time if your assume

446

00:19:49,480 --> 00:19:47,930

conservation of energy you will

447

00:19:51,790 --> 00:19:49,490

definitely get conservation of energy

448

00:19:53,680 --> 00:19:51,800

and continuous deal but if you don't

449

00:19:57,730 --> 00:19:53,690

make those assumptions it's a whole new

450

00:19:59,260 --> 00:19:57,740

ballgame okay so ah there's a question

451
00:20:09,460 --> 00:19:59,270
back there if we still got time for one

452
00:20:11,980 --> 00:20:09,470
more last question Thanks so I just want

453
00:20:14,320 --> 00:20:11,990
to confirm that which some something

454
00:20:17,200 --> 00:20:14,330
that I agree with to it to a good extent

455
00:20:19,540 --> 00:20:17,210
that the third derivative is essentially

456
00:20:21,040 --> 00:20:19,550
you called it control it's an ability to

457
00:20:22,780 --> 00:20:21,050
change from an acceleration to a

458
00:20:27,160 --> 00:20:22,790
different acceleration and does that

459
00:20:28,870 --> 00:20:27,170
essentially point to free will or a lack

460
00:20:30,820 --> 00:20:28,880
of determinism is that what gives us the

461
00:20:34,690 --> 00:20:30,830
element of ability to have free will in

462
00:20:37,030 --> 00:20:34,700
in life yes I somehow didn't actually

463
00:20:39,070 --> 00:20:37,040

use the word free will do just realize

464

00:20:41,530 --> 00:20:39,080

that no that's precisely what it is to

465

00:20:42,820 --> 00:20:41,540

control the third derivative would be at

466

00:20:44,440 --> 00:20:42,830

least from author Young's point of view

467

00:20:47,040 --> 00:20:44,450

free will and I think that's probably

468

00:20:49,510 --> 00:20:47,050

where it comes in but it's that key

469

00:20:51,570 --> 00:20:49,520

earlier today we are mr. hope was

470

00:20:53,010 --> 00:20:51,580

talking about this wonderful where he

471

00:20:55,470 --> 00:20:53,020

good spoon bending and I have to tell

472

00:20:58,740 --> 00:20:55,480

you I did 11 turn her spoon like this

473

00:21:01,350 --> 00:20:58,750

and then I was ready to go who's it and

474

00:21:03,300 --> 00:21:01,360

then you know I later I couldn't bend

475

00:21:05,820 --> 00:21:03,310

that spoon by myself but it just did

476

00:21:09,600 --> 00:21:05,830

that and it's just that real real quick

477

00:21:10,890 --> 00:21:09,610

point and somehow there's the source or

478

00:21:12,870 --> 00:21:10,900

something that I'm getting energy from

479

00:21:17,160 --> 00:21:12,880

some when they are the rest the universe