



1  
00:00:25,080 --> 00:00:16,080

[Music]

2  
00:00:28,500 --> 00:00:25,090

this is the first time I attend one of

3  
00:00:32,009 --> 00:00:28,510

your meetings and I was introduced to

4  
00:00:36,689 --> 00:00:32,019

this group about 12 years ago by John

5  
00:00:39,119 --> 00:00:36,699

Deere retired USGS geologist who had a

6  
00:00:41,880 --> 00:00:39,129

hard time living in the US GS

7  
00:00:45,719 --> 00:00:41,890

environment because they are hostile to

8  
00:00:50,039 --> 00:00:45,729

new ideas so he introduced me into this

9  
00:00:53,549 --> 00:00:50,049

and then he talked me into writing a

10  
00:00:55,859 --> 00:00:53,559

paper about 12 years ago on what I think

11  
00:00:58,789 --> 00:00:55,869

three earthquake signals might be

12  
00:01:01,350 --> 00:00:58,799

because I have spent the preceding

13  
00:01:03,780 --> 00:01:01,360

decades studying from a solid state

14

00:01:06,270 --> 00:01:03,790

physics viewpoint certain properties of

15

00:01:08,880 --> 00:01:06,280

materials and rocks and minerals that

16

00:01:11,240 --> 00:01:08,890

led me to believe that many of the

17

00:01:15,120 --> 00:01:11,250

reported pre-earthquake signals are

18

00:01:16,890 --> 00:01:15,130

actually produced by a phenomenon that

19

00:01:19,860 --> 00:01:16,900

had been consistently over see

20

00:01:22,850 --> 00:01:19,870

overlooked and that is linked to the

21

00:01:25,680 --> 00:01:22,860

generation of electricity in rocks and

22

00:01:27,930 --> 00:01:25,690

when I started to understand the physics

23

00:01:30,480 --> 00:01:27,940

I this I said well I'll go ahead and

24

00:01:33,000 --> 00:01:30,490

write this paper and what I can tell you

25

00:01:37,770 --> 00:01:33,010

today is what I wrote 12 years ago 11

26  
00:01:40,110 --> 00:01:37,780  
years ago is has become 19 percent true

27  
00:01:43,560 --> 00:01:40,120  
there was no basic mistake in this thing

28  
00:01:46,320 --> 00:01:43,570  
so I want to quickly go through and it's

29  
00:01:48,570 --> 00:01:46,330  
a very broad Singh area so I don't

30  
00:01:50,790 --> 00:01:48,580  
cannot go into many details but

31  
00:01:55,350 --> 00:01:50,800  
earthquakes are the deadliest of all

32  
00:01:57,800 --> 00:01:55,360  
natural disasters and the society as in

33  
00:02:01,110 --> 00:01:57,810  
which we live now has about this way of

34  
00:02:03,450 --> 00:02:01,120  
dealing with the danger they wait until

35  
00:02:05,280 --> 00:02:03,460  
an earthquake happens and they bury the

36  
00:02:09,149 --> 00:02:05,290  
dead clean up the mess

37  
00:02:11,610 --> 00:02:09,159  
right new building codes wait under the

38  
00:02:17,270 --> 00:02:11,620

next disaster will happen and my

39

00:02:23,400 --> 00:02:20,690

now there's a large community

40

00:02:25,589 --> 00:02:23,410

well-funded community of seismologists

41

00:02:28,110 --> 00:02:25,599

out there and they have done wonderful

42

00:02:31,470 --> 00:02:28,120

work but they are doing it in a very

43

00:02:33,119 --> 00:02:31,480

narrow sector because they look at past

44

00:02:34,729 --> 00:02:33,129

earthquakes and calculate the

45

00:02:38,880 --> 00:02:34,739

probabilities of future earthquakes

46

00:02:41,039 --> 00:02:38,890

something like life insurance companies

47

00:02:43,740 --> 00:02:41,049

are doing they have a million customers

48

00:02:47,190 --> 00:02:43,750

and they know exactly how many of their

49

00:02:49,350 --> 00:02:47,200

customers will die next month but they

50

00:02:52,289 --> 00:02:49,360

will never tell you who it is who will

51  
00:02:55,229 --> 00:02:52,299  
die so the statistic of small numbers

52  
00:02:58,550 --> 00:02:55,239  
kill the possibility of predicting and

53  
00:03:00,870 --> 00:02:58,560  
that is the problem of the seismologists

54  
00:03:03,030 --> 00:03:00,880  
what they are doing is as knowledge

55  
00:03:04,589 --> 00:03:03,040  
interviewing they have to wait as a

56  
00:03:07,740 --> 00:03:04,599  
function of their techniques that you're

57  
00:03:14,190 --> 00:03:07,750  
using until something happens and the

58  
00:03:19,020 --> 00:03:14,200  
magnitude one earthquake creates a

59  
00:03:20,849 --> 00:03:19,030  
rupture of about 1 million square feet

60  
00:03:23,550 --> 00:03:20,859  
in the Earth's crust

61  
00:03:26,099 --> 00:03:23,560  
only that large fracture will stick it

62  
00:03:28,800 --> 00:03:26,109  
will produce a signal that is called a

63  
00:03:31,289 --> 00:03:28,810

magnitude one which is very difficulty

64

00:03:33,720 --> 00:03:31,299

ticked so if you go up to a magnitude 8

65

00:03:35,870 --> 00:03:33,730

or 9 a magnitude 9 earthquake really is

66

00:03:38,970 --> 00:03:35,880

energy about 2 million atomic bombs

67

00:03:44,160 --> 00:03:38,980

exploding exploding simultaneously and

68

00:03:46,500 --> 00:03:44,170

people seismologists don't get it a hint

69

00:03:50,190 --> 00:03:46,510

that something like this might be coming

70

00:03:52,409 --> 00:03:50,200

so there's something wrong we have to

71

00:03:54,839 --> 00:03:52,419

understand what happens before the

72

00:03:57,960 --> 00:03:54,849

Earth's weekly rupture and that's

73

00:04:00,809 --> 00:03:57,970

essentially what I did so here you see

74

00:04:05,460 --> 00:04:00,819

an experiment that we did some 10 years

75

00:04:08,699 --> 00:04:05,470

ago in here at NASA Ames with a very old

76  
00:04:12,300 --> 00:04:08,709  
hydraulic press and what you see there

77  
00:04:15,089 --> 00:04:12,310  
is a 4 5 meter long granite rock and on

78  
00:04:18,029 --> 00:04:15,099  
the far end we have copper electrodes

79  
00:04:20,099 --> 00:04:18,039  
and two Pistons electrically insulated

80  
00:04:24,629 --> 00:04:20,109  
from the press and at the front you see

81  
00:04:28,830 --> 00:04:24,639  
a copper contact and between the two

82  
00:04:29,790 --> 00:04:28,840  
there's just a electrometer a picot a

83  
00:04:33,510 --> 00:04:29,800  
meter

84  
00:04:37,020 --> 00:04:33,520  
and we we start stressing we immediately

85  
00:04:41,189 --> 00:04:37,030  
see in the moment we stress there is a

86  
00:04:43,680 --> 00:04:41,199  
current flowing and as we increase the

87  
00:04:45,689 --> 00:04:43,690  
stress ik the current saturates and then

88  
00:04:48,390 --> 00:04:45,699

when we keep it constant the current

89

00:04:50,159 --> 00:04:48,400

good in caves and that goes on we have

90

00:04:52,469 --> 00:04:50,169

done this experiment over two and a half

91

00:04:55,379 --> 00:04:52,479

month the current continues to decay

92

00:04:58,020 --> 00:04:55,389

when we remove the stress the current

93

00:05:00,869 --> 00:04:58,030

eventually goes away what this is

94

00:05:03,059 --> 00:05:00,879

actually the rocks are you have no time

95

00:05:06,209 --> 00:05:03,069

to go into the details but the rock

96

00:05:08,219 --> 00:05:06,219

behaves like a battery a semiconductor

97

00:05:10,499 --> 00:05:08,229

battery that in the moment your stress

98

00:05:15,420 --> 00:05:10,509

you activate some defects in the

99

00:05:18,659 --> 00:05:15,430

minerals these defects fall apart form

100

00:05:20,760 --> 00:05:18,669

electron hole pairs the electrons are

101  
00:05:23,580 --> 00:05:20,770  
tied to the volume that is being

102  
00:05:25,830 --> 00:05:23,590  
stressed and the holes can flow out they

103  
00:05:28,140 --> 00:05:25,840  
flow at about 200 meters per second and

104  
00:05:31,439 --> 00:05:28,150  
they travel we now have evidence we know

105  
00:05:33,390 --> 00:05:31,449  
we can produce them upon command and we

106  
00:05:36,600 --> 00:05:33,400  
see them over a hundred kilometers

107  
00:05:40,140 --> 00:05:36,610  
distance as I spread out this is a very

108  
00:05:42,779 --> 00:05:40,150  
interesting and powerful phenomena so

109  
00:05:45,570 --> 00:05:42,789  
when rocks are stressed they turn into a

110  
00:05:49,830 --> 00:05:45,580  
battery and these electron hole pairs

111  
00:05:52,080 --> 00:05:49,840  
are just semiconductor physics the

112  
00:05:55,409 --> 00:05:52,090  
electrons stay behind the holes flow out

113  
00:05:59,100 --> 00:05:55,419

well why do they flow out and what are

114

00:06:01,860 --> 00:05:59,110

they now here's the only equation that I

115

00:06:03,570 --> 00:06:01,870

want to show you and that is a very very

116

00:06:07,260 --> 00:06:03,580

simple phenomenon namely

117

00:06:09,899 --> 00:06:07,270

in minerals you always have an oxygen

118

00:06:13,230 --> 00:06:09,909

bond between they say two silicon atoms

119

00:06:15,510 --> 00:06:13,240

or aluminum silicon atoms and that is

120

00:06:17,700 --> 00:06:15,520

the structure of minerals but due to

121

00:06:20,159 --> 00:06:17,710

some processes that I that's how I

122

00:06:21,990 --> 00:06:20,169

became aware of these things that happen

123

00:06:24,629 --> 00:06:22,000

during the cooling from high

124

00:06:28,040 --> 00:06:24,639

temperatures there are processes by

125

00:06:30,899 --> 00:06:28,050

which the electrons of the oxygens are

126

00:06:32,909 --> 00:06:30,909

given away they are given away actually

127

00:06:35,670 --> 00:06:32,919

two protons which become molecular

128

00:06:37,589 --> 00:06:35,680

hydrogen and what is left behind are two

129

00:06:40,279 --> 00:06:37,599

oxygens which a chemist called the

130

00:06:44,249 --> 00:06:40,289

peroxy the stuff you have in your

131

00:06:47,020 --> 00:06:44,259

detergent for us as a mild oxidant

132

00:06:48,700 --> 00:06:47,030

they are sitting there as defects in

133

00:06:51,730 --> 00:06:48,710

minerals and they do nothing you can't

134

00:06:53,920 --> 00:06:51,740

you can't see them until you stress them

135

00:06:56,950 --> 00:06:53,930

or you heat them or you shine UV light

136

00:06:59,620 --> 00:06:56,960

on them then they play the part they

137

00:07:02,439 --> 00:06:59,630

form an electron hole pair the electron

138

00:07:04,390 --> 00:07:02,449

gets trapped sits in energy levels

139

00:07:08,620 --> 00:07:04,400

slightly below the edge of the valence

140

00:07:10,719 --> 00:07:08,630

band and the the hole is associated with

141

00:07:12,969 --> 00:07:10,729

the energy levels at the edge of the

142

00:07:15,840 --> 00:07:12,979

valence band and that allows them to

143

00:07:18,730 --> 00:07:15,850

propagate through through the grains

144

00:07:21,310 --> 00:07:18,740

jump grain boundaries go from rock to

145

00:07:26,980 --> 00:07:21,320

rock and do a number of interesting

146

00:07:30,129 --> 00:07:26,990

things so rocks turn into a battery

147

00:07:33,370 --> 00:07:30,139

that's a rather fundamental discovery

148

00:07:35,650 --> 00:07:33,380

and it's very strange that it took so

149

00:07:38,140 --> 00:07:35,660

long long time it was happening this it

150

00:07:40,900 --> 00:07:38,150

should have discovered in twenties and I

151

00:07:43,749 --> 00:07:40,910

ran across this over a period of wealth

152

00:07:46,570 --> 00:07:43,759

almost 30 years starting the first hint

153

00:07:48,640 --> 00:07:46,580

I got that this was in the late 60s

154

00:07:51,850 --> 00:07:48,650

early 70s that we published the first

155

00:07:53,620 --> 00:07:51,860

paper in mid 70s and ever since I have

156

00:07:55,779 --> 00:07:53,630

come back to this question even though

157

00:07:58,300 --> 00:07:55,789

through my academic career back in

158

00:08:00,969 --> 00:07:58,310

Germany and then the last 25 years here

159

00:08:06,490 --> 00:08:00,979

at NASA I have done many other things on

160

00:08:09,250 --> 00:08:06,500

the side so it's a new chapter in

161

00:08:11,320 --> 00:08:09,260

earthquake physics but not only in Seoul

162

00:08:14,770 --> 00:08:11,330

this is actually a new chapter in

163

00:08:17,950 --> 00:08:14,780

material science and solid-state now

164

00:08:21,370 --> 00:08:17,960

here is a one image that I want to show

165

00:08:24,089 --> 00:08:21,380

you twice and what

166

00:08:27,850 --> 00:08:24,099

that's essentially what is happening you

167

00:08:31,600 --> 00:08:27,860

stress a rock down there ten kilometers

168

00:08:34,990 --> 00:08:31,610

below the earth you activate electron

169

00:08:38,050 --> 00:08:35,000

hole pairs the holes flow out they reach

170

00:08:40,329 --> 00:08:38,060

the surface and at the surface they

171

00:08:43,779 --> 00:08:40,339

accumulate because of the dielectric

172

00:08:48,070 --> 00:08:43,789

constant difference between air and the

173

00:08:50,110 --> 00:08:48,080

solid and there are many processes that

174

00:08:52,990 --> 00:08:50,120

happen at this interface and we can

175

00:08:56,110 --> 00:08:53,000

measure all of them with a number of

176

00:09:02,560 --> 00:08:56,120

different techniques now one technique

177

00:09:06,810 --> 00:09:02,570

that we are using is that we look at

178

00:09:09,790 --> 00:09:06,820

when these hole carriers become

179

00:09:12,670 --> 00:09:09,800

accumulated and reach higher number

180

00:09:16,269 --> 00:09:12,680

densities per area of volumes they start

181

00:09:19,000 --> 00:09:16,279

to recombine now it did cost energy to

182

00:09:21,490 --> 00:09:19,010

chase them out of bed down there 1020

183

00:09:24,670 --> 00:09:21,500

kilometer the earthquake is starting to

184

00:09:25,990 --> 00:09:24,680

happen it takes about two electron volts

185

00:09:28,300 --> 00:09:26,000

a little bit more two point four

186

00:09:31,810 --> 00:09:28,310

electron volts of energy and when they

187

00:09:33,880 --> 00:09:31,820

recombine this energy is released but it

188

00:09:36,550 --> 00:09:33,890

is not released it is released on the

189

00:09:39,010 --> 00:09:36,560

two oxygens there are lucky enough or

190

00:09:41,400 --> 00:09:39,020

unlucky enough to participate in this

191

00:09:44,319 --> 00:09:41,410

recombination though they are

192

00:09:46,680 --> 00:09:44,329

vibrationally highly excited at the tune

193

00:09:50,590 --> 00:09:46,690

of about twenty to twenty-five thousand

194

00:09:53,620 --> 00:09:50,600

degrees Kelvin and they instantly emit

195

00:09:55,890 --> 00:09:53,630

infrared photons as they tumble down the

196

00:09:58,510 --> 00:09:55,900

staircase to come back to a

197

00:10:01,630 --> 00:09:58,520

thermodynamic equilibrium so we are

198

00:10:04,360 --> 00:10:01,640

expecting to see infrared photons

199

00:10:07,300 --> 00:10:04,370

emission from the surface of the rocks

200

00:10:08,980 --> 00:10:07,310

that we are and this emission happens to

201  
00:10:10,600 --> 00:10:08,990  
be in the thermal in the middle infrared

202  
00:10:12,640 --> 00:10:10,610  
where the thermal emission those are

203  
00:10:16,449 --> 00:10:12,650  
satellites looking down on the earth

204  
00:10:20,110 --> 00:10:16,459  
seeing some strange increase in infrared

205  
00:10:23,380 --> 00:10:20,120  
radiation in the area were to three days

206  
00:10:25,569 --> 00:10:23,390  
later there will be a big earthquake the

207  
00:10:28,439 --> 00:10:25,579  
satellites phone a down and say I see

208  
00:10:31,090 --> 00:10:28,449  
heat but it's not heat it's an infrared

209  
00:10:34,240 --> 00:10:31,100  
luminescence that had never before been

210  
00:10:36,220 --> 00:10:34,250  
described it's depending on this quantum

211  
00:10:39,579 --> 00:10:36,230  
transitions between the vibration of

212  
00:10:41,860 --> 00:10:39,589  
excited States then now we can look at

213  
00:10:44,790 --> 00:10:41,870

what do these positive holes do further

214

00:10:47,410 --> 00:10:44,800

well they're all positively charged

215

00:10:48,370 --> 00:10:47,420

relative to their environment though

216

00:10:50,860 --> 00:10:48,380

they hate each other

217

00:10:53,560 --> 00:10:50,870

electrostatically Coulomb repulsion will

218

00:10:55,800 --> 00:10:53,570

push them apart until they reach the

219

00:10:59,500 --> 00:10:55,810

surface and where they become trapped

220

00:11:02,110 --> 00:10:59,510

but why they travel when they hit the

221

00:11:04,630 --> 00:11:02,120

earth they will look mostly for

222

00:11:06,939 --> 00:11:04,640

topographic Heights though most of these

223

00:11:08,770 --> 00:11:06,949

processes will happen on the

224

00:11:11,590 --> 00:11:08,780

mountaintops rather than in the

225

00:11:14,260 --> 00:11:11,600

values and this we can use in the area

226  
00:11:17,740 --> 00:11:14,270  
of earthquake prediction you have heard

227  
00:11:20,410 --> 00:11:17,750  
this earthquake in Italy L'Aquila which

228  
00:11:23,530 --> 00:11:20,420  
became famous because I'm seismologist

229  
00:11:26,470 --> 00:11:23,540  
stupidly sit assured the local people

230  
00:11:28,960 --> 00:11:26,480  
there will be no earthquake go home and

231  
00:11:30,850 --> 00:11:28,970  
have a glass of wine and then three days

232  
00:11:33,220 --> 00:11:30,860  
or two days later the earthquake hit and

233  
00:11:35,440 --> 00:11:33,230  
some 300 plus people were killed though

234  
00:11:38,170 --> 00:11:35,450  
these colleges are in person right now

235  
00:11:41,530 --> 00:11:38,180  
or at least they are sensitive to prison

236  
00:11:44,080 --> 00:11:41,540  
there is the earthquake center the old

237  
00:11:47,200 --> 00:11:44,090  
town of l'aquila which was so severely

238  
00:11:50,920 --> 00:11:47,210

damaged so this is a valley that is just

239

00:11:53,800 --> 00:11:50,930

dissected by four or five known seismo

240

00:11:56,200 --> 00:11:53,810

genic faults which ruptured and at the

241

00:11:59,110 --> 00:11:56,210

round you see here the cran salsa which

242

00:12:04,360 --> 00:11:59,120

is the highest mountains in Peninsula of

243

00:12:06,760 --> 00:12:04,370

Italy and now when you look at this the

244

00:12:09,070 --> 00:12:06,770

same picture on the left and on the

245

00:12:12,580 --> 00:12:09,080

right you'll see is the infrared anomaly

246

00:12:15,820 --> 00:12:12,590

that this is picked up by satellites it

247

00:12:19,930 --> 00:12:15,830

is the mountaintops that are shining as

248

00:12:23,170 --> 00:12:19,940

if they were set ablaze and that is

249

00:12:25,810 --> 00:12:23,180

infrared radiation that is coming from

250

00:12:27,760 --> 00:12:25,820

the rocks it's not heat its

251

00:12:30,400 --> 00:12:27,770

spectroscopically different from the

252

00:12:36,250 --> 00:12:30,410

heat but it occurs in the same spectral

253

00:12:39,130 --> 00:12:36,260

window and actually we are now starting

254

00:12:41,320 --> 00:12:39,140

a global earthquake forecasting system

255

00:12:44,080 --> 00:12:41,330

which will have a satellite component

256

00:12:45,670 --> 00:12:44,090

where we want to develop the satellite

257

00:12:48,370 --> 00:12:45,680

technology to look at these things

258

00:12:50,290 --> 00:12:48,380

spectroscopically not just integrate

259

00:12:53,530 --> 00:12:50,300

over the infrared window and say it

260

00:12:56,740 --> 00:12:53,540

looks like heat no way we can see it we

261

00:13:00,160 --> 00:12:56,750

can see the color of these things you're

262

00:13:03,840 --> 00:13:00,170

the same thing now just the talk that

263

00:13:08,220 --> 00:13:03,850

you gave we refer to these

264

00:13:11,290 --> 00:13:08,230

extraterrestrials many of these ideas

265

00:13:16,230 --> 00:13:11,300

emerge because people at night sometimes

266

00:13:19,570 --> 00:13:16,240

see strange luminous phenomena glows of

267

00:13:22,000 --> 00:13:19,580

glowing balls floating through the air

268

00:13:24,070 --> 00:13:22,010

zigzagging very fast

269

00:13:27,010 --> 00:13:24,080

earthquake lights we just published

270

00:13:28,930 --> 00:13:27,020

earlier this year a big paper reviewing

271

00:13:31,540 --> 00:13:28,940

400 years of earthquakes light and we

272

00:13:33,910 --> 00:13:31,550

got it published in the core Journal of

273

00:13:36,730 --> 00:13:33,920

seismology and seismological Research

274

00:13:39,070 --> 00:13:36,740

Letters and it created quite a stir and

275

00:13:42,310 --> 00:13:39,080

some of the seismologist had to scratch

276

00:13:47,920 --> 00:13:42,320

their head and say well can we accept

277

00:13:49,450 --> 00:13:47,930

this or so we are studying and we have

278

00:13:51,940 --> 00:13:49,460

not yet reached the point where that we

279

00:13:54,460 --> 00:13:51,950

can reproduce it in the laboratory but

280

00:13:56,170 --> 00:13:54,470

we are getting close to it so what I

281

00:13:58,630 --> 00:13:56,180

want to show you is something different

282

00:14:01,050 --> 00:13:58,640

namely when the number of charge

283

00:14:04,360 --> 00:14:01,060

carrying at the surface of the earth

284

00:14:07,110 --> 00:14:04,370

increases to a concern D an Associated

285

00:14:11,740 --> 00:14:07,120

electric field at the interface between

286

00:14:14,950 --> 00:14:11,750

rock and air or ground and air becomes

287

00:14:18,220 --> 00:14:14,960

so high that air molecules become field

288

00:14:21,010 --> 00:14:18,230

ionized so the related air molecules

289

00:14:23,020 --> 00:14:21,020

mostly oxygen molecules donate an

290

00:14:25,270 --> 00:14:23,030

electron they lose an electron to the

291

00:14:27,940 --> 00:14:25,280

ground which goes back into the big

292

00:14:32,050 --> 00:14:27,950

ground of the planet and they float away

293

00:14:34,870 --> 00:14:32,060

or are pushed away as prostitution

294

00:14:37,480 --> 00:14:34,880

charged air ions and this happens over

295

00:14:39,040 --> 00:14:37,490

an area of four magnitude five six

296

00:14:43,000 --> 00:14:39,050

earthquake over an area of about a

297

00:14:44,980 --> 00:14:43,010

hundred or 200 kilometers across happens

298

00:14:46,870 --> 00:14:44,990

impulses because there are couple

299

00:14:48,550 --> 00:14:46,880

processes from the transport of the

300

00:14:50,740 --> 00:14:48,560

charges through the earth and these

301

00:14:53,170 --> 00:14:50,750

ionization processes these are very

302

00:14:56,050 --> 00:14:53,180

interesting kinetic processes they come

303

00:14:58,390 --> 00:14:56,060

at pulses and they form a bubble that

304

00:15:00,820 --> 00:14:58,400

rises through the stratosphere and then

305

00:15:03,250 --> 00:15:00,830

continues their way up into the

306

00:15:05,200 --> 00:15:03,260

atmosphere and that's other aspects that

307

00:15:10,330 --> 00:15:05,210

we are studying and we want to study

308

00:15:13,030 --> 00:15:10,340

with the help of NASA and if a bubble of

309

00:15:15,790 --> 00:15:13,040

positive ionized air rises to let's say

310

00:15:17,410 --> 00:15:15,800

10 50 kilometers just by ballistic

311

00:15:20,050 --> 00:15:17,420

expansion upward due to the

312

00:15:24,100 --> 00:15:20,060

electrostatic repulsion among the ions

313

00:15:26,950 --> 00:15:24,110

the plasma in the ionosphere of course

314

00:15:29,350 --> 00:15:26,960

responds like a capacitor plate the

315

00:15:31,420 --> 00:15:29,360

plasma is neutral it has positive ions

316

00:15:34,030 --> 00:15:31,430

and lots of electrons and the electrons

317

00:15:35,120 --> 00:15:34,040

are negative and they come down about

318

00:15:38,930 --> 00:15:35,130

the same

319

00:15:41,030 --> 00:15:38,940

as the positive charges drifting upwards

320

00:15:43,160 --> 00:15:41,040

and moving upwards through the air and

321

00:15:45,830 --> 00:15:43,170

we can develop this in great detail and

322

00:15:50,630 --> 00:15:45,840

we see a number of interesting phenomena

323

00:15:55,250 --> 00:15:50,640

but this coming down of the electrons in

324

00:15:59,630 --> 00:15:55,260

the answer is known as a Tec total

325

00:16:02,060 --> 00:15:59,640

electron content anomaly and that's oh I

326

00:16:06,220 --> 00:16:02,070

forgot to mention one more thing yes

327

00:16:10,250 --> 00:16:06,230

please as the charges are building up

328

00:16:12,770 --> 00:16:10,260

things on the surface of the earth pick

329

00:16:15,050 --> 00:16:12,780

up this charge so there is a paper by

330

00:16:18,260 --> 00:16:15,060

Tony Fraser's mace that he published in

331

00:16:20,000 --> 00:16:18,270

1978 and what he had done and we are now

332

00:16:22,880 --> 00:16:20,010

repeating this we start actually on

333

00:16:25,760 --> 00:16:22,890

Monday this series of experiment he just

334

00:16:28,040 --> 00:16:25,770

put two nails in an oak tree appear on

335

00:16:31,880 --> 00:16:28,050

Stanford campus and measured the

336

00:16:35,050 --> 00:16:31,890

microworld signal and at 3 act as an

337

00:16:38,000 --> 00:16:35,060

antenna and it picks up all kinds of

338

00:16:40,370 --> 00:16:38,010

electromagnetic signals that come either

339

00:16:43,670 --> 00:16:40,380

from the outside and what you see there

340

00:16:46,640 --> 00:16:43,680

that are actually electromagnetic pulses

341

00:16:49,190 --> 00:16:46,650

that come from the geotech from the

342

00:16:51,650 --> 00:16:49,200

magneto teal tail when the earth plows

343

00:16:54,020 --> 00:16:51,660

through the solar wind there is in the

344

00:16:55,790 --> 00:16:54,030

wake there are turbulences in the

345

00:16:58,550 --> 00:16:55,800

magnetic field which collapse and

346

00:17:01,700 --> 00:16:58,560

produce these pulses known as pc-1 pc2

347

00:17:04,130 --> 00:17:01,710

abilities freeze and what you see on the

348

00:17:06,439 --> 00:17:04,140

top there is a tree potential on the

349

00:17:09,500 --> 00:17:06,449

right the signal here plotted as

350

00:17:11,990 --> 00:17:09,510

frequency over time and you see one of

351  
00:17:14,240 --> 00:17:12,000  
these PC ones and the bottom is

352  
00:17:17,059 --> 00:17:14,250  
something that would nowadays cost

353  
00:17:19,280 --> 00:17:17,069  
\$50,000 magnetometer to pick up the

354  
00:17:22,490 --> 00:17:19,290  
thing the tree is better at picking up

355  
00:17:26,059 --> 00:17:22,500  
these signals than the \$50,000 and we

356  
00:17:28,670 --> 00:17:26,069  
have \$50,000 instruments at NASA and we

357  
00:17:31,790 --> 00:17:28,680  
are going to repeat this now exactly and

358  
00:17:34,700 --> 00:17:31,800  
we all see and whether we can learn more

359  
00:17:36,620 --> 00:17:34,710  
about by incorporating what we have

360  
00:17:41,750 --> 00:17:36,630  
learned since the spoke paper was

361  
00:17:44,470 --> 00:17:41,760  
published in 74 now another things which

362  
00:17:48,400 --> 00:17:44,480  
is of interest in you to your community

363  
00:17:52,549 --> 00:17:48,410

you all have heard that animals can

364

00:17:54,680 --> 00:17:52,559

kind of feel something is coming and we

365

00:17:56,780 --> 00:17:54,690

have lots of data that this is true we

366

00:17:59,690 --> 00:17:56,790

are in the process of publishing some of

367

00:18:02,360 --> 00:17:59,700

it here is something that just blew me

368

00:18:04,310 --> 00:18:02,370

away when I first read it I was asked to

369

00:18:06,620 --> 00:18:04,320

review this paper and this published

370

00:18:09,650 --> 00:18:06,630

first in a book published by a Russian

371

00:18:12,470 --> 00:18:09,660

author and what had happened is in 2003

372

00:18:15,740 --> 00:18:12,480

there was a big magnet 11.6 earthquake

373

00:18:18,919 --> 00:18:15,750

in a sparse relatively sparsely

374

00:18:21,350 --> 00:18:18,929

populated part of southern Siberia at

375

00:18:23,780 --> 00:18:21,360

the boundary between Russia and Mongolia

376

00:18:26,060 --> 00:18:23,790

and there's a gentleman by name

377

00:18:28,010 --> 00:18:26,070

Alexander Sedov he took it upon himself

378

00:18:31,010 --> 00:18:28,020

after the earthquake to go through

379

00:18:33,260 --> 00:18:31,020

everything he could put his hands on to

380

00:18:35,330 --> 00:18:33,270

identify what had happened before this

381

00:18:37,220 --> 00:18:35,340

earthquake and he got hold of the

382

00:18:42,710 --> 00:18:37,230

medical records of the whole province

383

00:18:45,020 --> 00:18:42,720

and the population is only 250,000

384

00:18:48,710 --> 00:18:45,030

people not a very high statistical

385

00:18:50,600 --> 00:18:48,720

number but the number of people over the

386

00:18:53,330 --> 00:18:50,610

long time average that came through the

387

00:18:56,000 --> 00:18:53,340

emergency rooms tripled during that

388

00:18:58,940 --> 00:18:56,010

period of time starting about 10 days

389

00:19:01,520 --> 00:18:58,950

before the earthquake nobody knew the

390

00:19:03,950 --> 00:19:01,530

earthquake was coming but people started

391

00:19:06,140 --> 00:19:03,960

to flock to the emergency room said

392

00:19:08,930 --> 00:19:06,150

something wrong with me and when you

393

00:19:11,120 --> 00:19:08,940

look why they came some of them had

394

00:19:14,650 --> 00:19:11,130

pneumonia that's on the left in the

395

00:19:17,720 --> 00:19:14,660

middle all the others that show a pre

396

00:19:18,740 --> 00:19:17,730

earthquake are related to the central

397

00:19:21,460 --> 00:19:18,750

nervous system

398

00:19:24,049 --> 00:19:21,470

epilepsy hypertension and all the other

399

00:19:26,330 --> 00:19:24,059

phenomena that clearly point that

400

00:19:29,870 --> 00:19:26,340

something is working there that

401  
00:19:32,120 --> 00:19:29,880  
interferes with the functioning of the

402  
00:19:33,500 --> 00:19:32,130  
central nervous system as those

403  
00:19:35,570 --> 00:19:33,510  
therefore and this has actually

404  
00:19:38,900 --> 00:19:35,580  
triggered and we got funding from NASA

405  
00:19:41,240 --> 00:19:38,910  
to study this now and we are getting

406  
00:19:45,890 --> 00:19:41,250  
down to the point with Victor Stoltz who

407  
00:19:48,020 --> 00:19:45,900  
was here on the first day you getting

408  
00:19:50,240 --> 00:19:48,030  
down to starting to understand what is

409  
00:19:52,549 --> 00:19:50,250  
happening between ultra low frequency

410  
00:19:56,860 --> 00:19:52,559  
electromagnetic waves and electron

411  
00:19:59,039 --> 00:19:56,870  
transfer processes in this single cells

412  
00:20:01,680 --> 00:19:59,049  
no now I'm

413  
00:20:04,470 --> 00:20:01,690

back to this one here so now I want to

414

00:20:08,249 --> 00:20:04,480

show you the ionosphere perturbations so

415

00:20:10,979 --> 00:20:08,259

when this bubble of positive air rises

416

00:20:13,919 --> 00:20:10,989

and the electron in the ionosphere

417

00:20:19,289 --> 00:20:13,929

plasma come down this is something that

418

00:20:21,419 --> 00:20:19,299

is easily shown by GPS technology

419

00:20:25,019 --> 00:20:21,429

actually the people who developed the

420

00:20:27,239 --> 00:20:25,029

GPS they saw that occasionally their GPS

421

00:20:30,210 --> 00:20:27,249

beams are deflected and the phase shift

422

00:20:34,769 --> 00:20:30,220

and they had to get go at great lengths

423

00:20:37,229 --> 00:20:34,779

to remove this dirt but that dirt is

424

00:20:39,840 --> 00:20:37,239

information on the accumulation of

425

00:20:42,210 --> 00:20:39,850

electrons and what people then found

426  
00:20:45,090 --> 00:20:42,220  
over a period of about twenty years or

427  
00:20:47,759 --> 00:20:45,100  
hundreds of publications of this kind is

428  
00:20:51,060 --> 00:20:47,769  
that before major earthquake there's an

429  
00:20:53,519 --> 00:20:51,070  
accumulation of electrons at the lower

430  
00:20:54,749 --> 00:20:53,529  
edge of the ionosphere before the

431  
00:20:58,409 --> 00:20:54,759  
earthquake and that is happening

432  
00:21:01,349 --> 00:20:58,419  
precision about seven to five seven to

433  
00:21:03,269 --> 00:21:01,359  
three days before the earthquake and

434  
00:21:05,849 --> 00:21:03,279  
here you see an earthquake that happened

435  
00:21:07,909 --> 00:21:05,859  
it's a good one which I ought I'd like

436  
00:21:12,509 --> 00:21:07,919  
to show but it's already happened in

437  
00:21:17,340 --> 00:21:12,519  
2002 it was analyzed in 2008 Alaska

438  
00:21:20,159 --> 00:21:17,350

Sagna 26.2 and you see on the left there

439

00:21:23,789 --> 00:21:20,169

is the 2d projection of the electron

440

00:21:26,759 --> 00:21:23,799

density relative to a normal density of

441

00:21:30,299 --> 00:21:26,769

the ionosphere projected over the map of

442

00:21:32,759 --> 00:21:30,309

Alaska and the things on the right and

443

00:21:34,669 --> 00:21:32,769

at the bottom are just vertical slices

444

00:21:38,460 --> 00:21:34,679

through the ionosphere in the

445

00:21:42,090 --> 00:21:38,470

north-south direction in this area so

446

00:21:43,590 --> 00:21:42,100

that is so we are now starting to

447

00:21:46,590 --> 00:21:43,600

implement a global earthquake

448

00:21:49,649 --> 00:21:46,600

forecasting system in at NASA Ames and

449

00:21:51,629 --> 00:21:49,659

we have already strong endorsement also

450

00:21:54,149 --> 00:21:51,639

from NASA and the European Space Agency

451

00:21:56,639 --> 00:21:54,159

and the United Nations to go ahead

452

00:21:59,999 --> 00:21:56,649

because the people who look at this they

453

00:22:02,639 --> 00:22:00,009

say the science makes sense we can go

454

00:22:05,789 --> 00:22:02,649

ahead and try to make use of it so now

455

00:22:08,580 --> 00:22:05,799

we are probably in three or five years

456

00:22:12,690 --> 00:22:08,590

we'll see that we'll get early warning

457

00:22:14,270 --> 00:22:12,700

not prediction but we can say that

458

00:22:17,100 --> 00:22:14,280

two or three days before there's a

459

00:22:18,960 --> 00:22:17,110

tremendous in charge to increase in the

460

00:22:23,430 --> 00:22:18,970

chance of having a major earthquake at

461

00:22:25,740 --> 00:22:23,440

such-and-such place globally so when I

462

00:22:28,740 --> 00:22:25,750

started with this and I'm still under

463

00:22:30,810 --> 00:22:28,750

this pressure from my dear friend amis

464

00:22:34,680 --> 00:22:30,820

in the US and the seismological

465

00:22:37,620 --> 00:22:34,690

community that I'm being called a fridge

466

00:22:42,390 --> 00:22:37,630

scientist and I think some of you know

467

00:22:45,420 --> 00:22:42,400

that term but now we start to understand

468

00:22:47,910 --> 00:22:45,430

the signs of physics behind this and we

469

00:22:50,040 --> 00:22:47,920

can say we can start to understand and

470

00:22:52,620 --> 00:22:50,050

there's I bring this quote from John

471

00:22:56,340 --> 00:22:52,630

Deere that he always adds to his email

472

00:23:04,160 --> 00:22:56,350

that the earth is stranger than we give

473

00:23:08,480 --> 00:23:05,870

Thank You freedom in for a very

474

00:23:10,820 --> 00:23:08,490

interesting talk I will make one comment

475

00:23:14,000 --> 00:23:10,830

that as you know I've been monitoring a

476

00:23:16,669 --> 00:23:14,010

tree since 1978 and also an antenna

477

00:23:20,120 --> 00:23:16,679

built to Navy specifications and the

478

00:23:22,669 --> 00:23:20,130

tree is better and Marshall will come

479

00:23:24,919 --> 00:23:22,679

and see me come to to NASA Ames on

480

00:23:36,540 --> 00:23:24,929

Monday so we'll have a wonderful day

481

00:23:42,930 --> 00:23:40,770

I have two questions the first is if I

482

00:23:45,750 --> 00:23:42,940

understood correctly if you take that

483

00:23:47,910 --> 00:23:45,760

long granite beam and you press on it

484

00:23:50,580 --> 00:23:47,920

you get current flow and the current

485

00:23:52,950 --> 00:23:50,590

continues for as long as you you're

486

00:23:54,930 --> 00:23:52,960

pressing don't you have a perpetual

487

00:23:57,060 --> 00:23:54,940

motion machine there nope you're

488

00:23:59,250 --> 00:23:57,070

essentially forming if you stress a

489

00:24:02,010 --> 00:23:59,260

little bit you form a kind of motorcycle

490

00:24:04,890 --> 00:24:02,020

battery if you stress more or if you

491

00:24:07,320 --> 00:24:04,900

threaten larger when you get a truck or

492

00:24:09,150 --> 00:24:07,330

a tank battery but you said the current

493

00:24:11,550 --> 00:24:09,160

keeps flowing as long as you've got the

494

00:24:14,460 --> 00:24:11,560

pressure on so if we keep slowing you

495

00:24:16,860 --> 00:24:14,470

battery has infinite power doesn't it

496

00:24:19,080 --> 00:24:16,870

yes because you maintain a voltage

497

00:24:21,300 --> 00:24:19,090

across from the stretch to the

498

00:24:23,910 --> 00:24:21,310

unstressed end and it has an internal

499

00:24:26,910 --> 00:24:23,920

resistance and that current flows until

500

00:24:29,070 --> 00:24:26,920

the battery is empty okay the second

501  
00:24:33,000 --> 00:24:29,080  
question the earth is known to have a

502  
00:24:35,310 --> 00:24:33,010  
net negative charge near the surface and

503  
00:24:37,710 --> 00:24:35,320  
that gives rise to the 100 volt per

504  
00:24:39,780 --> 00:24:37,720  
meter electric field that's but you

505  
00:24:43,980 --> 00:24:39,790  
never mention that is it possible that

506  
00:24:46,020 --> 00:24:43,990  
somehow the the electrons or whatever it

507  
00:24:48,450 --> 00:24:46,030  
is that carries the negative charge just

508  
00:24:50,250 --> 00:24:48,460  
beneath the surface of the earth somehow

509  
00:24:53,730 --> 00:24:50,260  
plays a role in what you're talking

510  
00:24:56,670 --> 00:24:53,740  
about interesting that you mentioned

511  
00:24:59,550 --> 00:24:56,680  
this because believe it or not it when

512  
00:25:02,460 --> 00:24:59,560  
goes back to Benjamin Franklin who was

513  
00:25:05,340 --> 00:25:02,470

the first to think about the postage

514

00:25:07,440 --> 00:25:05,350

difference between up and down and at

515

00:25:09,180 --> 00:25:07,450

that time as you know the sign of the

516

00:25:11,490 --> 00:25:09,190

polarity of the current was not yet

517

00:25:15,390 --> 00:25:11,500

defined and he called it right he said

518

00:25:18,630 --> 00:25:15,400

the earth ground is positive and the

519

00:25:21,090 --> 00:25:18,640

ionosphere is negative however then in

520

00:25:23,340 --> 00:25:21,100

the 1920s some very famous people wrote

521

00:25:25,200 --> 00:25:23,350

the letter a rolled-up paper says the

522

00:25:27,330 --> 00:25:25,210

err no no no the earth is negative and

523

00:25:30,270 --> 00:25:27,340

the ionosphere is positive and everybody

524

00:25:32,610 --> 00:25:30,280

copies this paper and therefore I talked

525

00:25:35,430 --> 00:25:32,620

to almost everybody in the global

526

00:25:38,010 --> 00:25:35,440

electric field discipline and they all

527

00:25:39,870 --> 00:25:38,020

say why like you said yes yours is

528

00:25:43,400 --> 00:25:39,880

negative and the answer and said how do

529

00:25:45,800 --> 00:25:43,410

you know oh that's how we learned it

530

00:25:50,350 --> 00:25:45,810

so I'm actually in the process of

531

00:25:53,840 --> 00:25:50,360

writing a competitive paper on saying

532

00:25:56,680 --> 00:25:53,850

listen you are wrong you misinterpret

533

00:25:59,960 --> 00:25:56,690

that the data the earth is positive and

534

00:26:02,420 --> 00:25:59,970

the ionosphere is negative because

535

00:26:04,610 --> 00:26:02,430

nobody has the means of these two

536

00:26:06,830 --> 00:26:04,620

hundred fifty thousand volts kilowatts

537

00:26:09,470 --> 00:26:06,840

that exists between to measure them

538

00:26:11,660 --> 00:26:09,480

directly they are inferred then we know

539

00:26:14,410 --> 00:26:11,670

there is this voltage but the polarity

540

00:26:16,990 --> 00:26:14,420

is actually not really directly known

541

00:26:20,270 --> 00:26:17,000

thanks Gary

542

00:26:23,030 --> 00:26:20,280

sorry for the long answer answer thank

543

00:26:25,550 --> 00:26:23,040

you for such an enlightening talk I'm

544

00:26:28,430 --> 00:26:25,560

concerned about how the ionosphere

545

00:26:31,190 --> 00:26:28,440

heaters and the proliferation of these

546

00:26:33,710 --> 00:26:31,200

by not only the HAARP project in Alaska

547

00:26:36,500 --> 00:26:33,720

but by many countries might Swart your

548

00:26:38,360 --> 00:26:36,510

efforts to look at this because of the

549

00:26:42,380 --> 00:26:38,370

disturbances in the ionosphere being

550

00:26:44,720 --> 00:26:42,390

created by these technologies yes that's

551  
00:26:47,240 --> 00:26:44,730  
absolutely correct and the ionosphere is

552  
00:26:51,170 --> 00:26:47,250  
also very heavily disturbed by any

553  
00:26:53,600 --> 00:26:51,180  
global coronal mass ejection from the

554  
00:26:57,260 --> 00:26:53,610  
Sun so geomagnetic storms and that is

555  
00:27:01,780 --> 00:26:57,270  
why our earthquake forecast system is

556  
00:27:04,850 --> 00:27:01,790  
built on trying to collect as many

557  
00:27:07,100 --> 00:27:04,860  
indicators as we can like the infrared

558  
00:27:09,920 --> 00:27:07,110  
emission but if it is cloudy you cannot

559  
00:27:11,690 --> 00:27:09,930  
see them so we have to some look at some

560  
00:27:14,210 --> 00:27:11,700  
other things if there's a geomagnetic

561  
00:27:16,790 --> 00:27:14,220  
storm we cannot use the ionosphere but

562  
00:27:19,430 --> 00:27:16,800  
we may be using the animal behavior we

563  
00:27:21,290 --> 00:27:19,440

may use water chemistry in the in the

564

00:27:23,720 --> 00:27:21,300

ground water or spring water there are

565

00:27:26,360 --> 00:27:23,730

many there we have about a list of 20

566

00:27:28,280 --> 00:27:26,370

different parameters that we can look

567

00:27:30,710 --> 00:27:28,290

and we will put them together in a

568

00:27:32,510 --> 00:27:30,720

decision tree just like NASA had to do

569

00:27:36,950 --> 00:27:32,520

when they launched the shuttle they have

570

00:27:39,230 --> 00:27:36,960

to go through ABCD check them off if

571

00:27:41,150 --> 00:27:39,240

there is some one thing which is wrong

572

00:27:44,210 --> 00:27:41,160

doesn't matter if it's not

573

00:27:47,420 --> 00:27:44,220

life-threatening you go ahead if it is

574

00:27:49,910 --> 00:27:47,430

then you start to worry about it

575

00:27:52,190 --> 00:27:49,920

briefly regarding the healthcare

576

00:27:55,410 --> 00:27:52,200

parameters from southern Russia it

577

00:27:58,620 --> 00:27:55,420

seemed to me that the four graphs on the

578

00:28:02,700 --> 00:27:58,630

had were rising fairly uniformly visa

579

00:28:04,860 --> 00:28:02,710

relatively to be other three so I'm

580

00:28:07,200 --> 00:28:04,870

wondering if if we could draw a parallel

581

00:28:10,380 --> 00:28:07,210

between the similarity of the cause and

582

00:28:12,000 --> 00:28:10,390

the disease is and the commonality

583

00:28:13,590 --> 00:28:12,010

between due to the fact that they're all

584

00:28:17,070 --> 00:28:13,600

rising at a similar rate if that's

585

00:28:19,530 --> 00:28:17,080

indeed the case yes I am pursue

586

00:28:21,750 --> 00:28:19,540

reproducing this image was this figure

587

00:28:23,700 --> 00:28:21,760

from that publication without really

588

00:28:26,550 --> 00:28:23,710

being I'm not in the medical field of

589

00:28:29,040 --> 00:28:26,560

course so I'm inviting people who would

590

00:28:31,290 --> 00:28:29,050

be interested in working with me and and

591

00:28:33,720 --> 00:28:31,300

see I'm in touch with it Alexander sheet

592

00:28:35,820 --> 00:28:33,730

off I want to invite him to come here in

593

00:28:41,760 --> 00:28:35,830

December I am organizing a small

594

00:28:43,590 --> 00:28:41,770

conference at at NASA Ames and I want to

595

00:28:46,920 --> 00:28:43,600

see whether we can establish some

596

00:28:49,350 --> 00:28:46,930

collaboration thank you for a

597

00:28:54,080 --> 00:28:49,360

fascinating I'm here for thee

598

00:28:59,700 --> 00:28:54,090

[Applause]