
exploratorium

1
00:00:42,470 --> 00:00:40,229
hello and welcome to micronesia i'm

2
00:00:44,869 --> 00:00:42,480
robin higdon from the exploratorium in

3
00:00:46,270 --> 00:00:44,879
san francisco we're gathered here today

4
00:00:49,270 --> 00:00:46,280
to experience one of the most

5
00:00:51,590 --> 00:00:49,280
spectacular of natural events a total

6
00:00:53,670 --> 00:00:51,600
solar eclipse the eclipse actually

7
00:00:55,350 --> 00:00:53,680
started about an hour ago so let's take

8
00:00:58,069 --> 00:00:55,360
a look

9
00:01:00,389 --> 00:00:58,079
what you're seeing now is a live video

10
00:01:01,590 --> 00:01:00,399
image from one of our telescopes

11
00:01:03,349 --> 00:01:01,600
and that

12
00:01:05,990 --> 00:01:03,359
big yellow ball

13
00:01:07,750 --> 00:01:06,000

is indeed our star the sun

14
00:01:09,990 --> 00:01:07,760
and it sort of looks like it's had a big

15
00:01:11,670 --> 00:01:10,000
bite taken out of it but you have to

16
00:01:14,230 --> 00:01:11,680
remember when you look at this image

17
00:01:16,390 --> 00:01:14,240
that that big black disk is really the

18
00:01:18,070 --> 00:01:16,400
moon you just can't see any detail on

19
00:01:20,789 --> 00:01:18,080
the surface because it's being so

20
00:01:22,710 --> 00:01:20,799
backlit by the sun

21
00:01:25,270 --> 00:01:22,720
so the eclipse actually started in a

22
00:01:28,310 --> 00:01:25,280
moment that we call first contact that's

23
00:01:30,550 --> 00:01:28,320
when that edge of the moon first touched

24
00:01:32,630 --> 00:01:30,560
the edge of the sun and it's been moving

25
00:01:34,710 --> 00:01:32,640
to our left ever since

26
00:01:37,030 --> 00:01:34,720
it's going to be about another 35

27
00:01:39,429 --> 00:01:37,040
minutes or so until that moon gets into

28
00:01:40,469 --> 00:01:39,439
position to completely block the disk of

29
00:01:42,550 --> 00:01:40,479
the sun

30
00:01:43,830 --> 00:01:42,560
so we're waiting for that to happen

31
00:01:45,590 --> 00:01:43,840
we're going to talk a little bit about

32
00:01:47,429 --> 00:01:45,600
the alignment what's going on over our

33
00:01:49,990 --> 00:01:47,439
heads today we're going to talk about

34
00:01:52,069 --> 00:01:50,000
why we're here in this beautiful but

35
00:01:54,149 --> 00:01:52,079
incredibly remote place

36
00:01:55,990 --> 00:01:54,159
we're going to bring on a nasa education

37
00:01:58,149 --> 00:01:56,000
specialist who's going to talk about the

38
00:01:59,830 --> 00:01:58,159

connection between the sun and the earth

39
00:02:01,830 --> 00:01:59,840
because in addition to providing us with

40
00:02:04,069 --> 00:02:01,840
all the light and energy we need for

41
00:02:06,709 --> 00:02:04,079
life on the planet there's also a hidden

42
00:02:08,869 --> 00:02:06,719
connection that creates great beauty but

43
00:02:11,029 --> 00:02:08,879
can also be a little scary

44
00:02:13,350 --> 00:02:11,039
and then i'll be back to get you ready

45
00:02:14,949 --> 00:02:13,360
to view totality and you'll want to stay

46
00:02:17,510 --> 00:02:14,959
tuned because after that we're going to

47
00:02:19,990 --> 00:02:17,520
talk about an incredible opportunity for

48
00:02:22,869 --> 00:02:20,000
millions of you to be where i am today

49
00:02:25,670 --> 00:02:22,879
in the path of totality but before that

50
00:02:27,589 --> 00:02:25,680
i want to show you the telescopes

51
00:02:30,229 --> 00:02:27,599
so this is building

52
00:02:32,630 --> 00:02:30,239
hey he's our telescope guy and an optics

53
00:02:34,710 --> 00:02:32,640
expert so bill we're just looking at a

54
00:02:43,110 --> 00:02:34,720
cool image of the sun which of these

55
00:02:47,350 --> 00:02:45,350
why don't you say that again

56
00:02:49,670 --> 00:02:47,360
this telescope our full disc white light

57
00:02:51,830 --> 00:02:49,680
telescope so this allows us to safely

58
00:02:53,509 --> 00:02:51,840
see the photosphere and of course at

59
00:02:55,750 --> 00:02:53,519
first and second contact we can see the

60
00:02:58,229 --> 00:02:55,760
moon going across the disk of the sun

61
00:03:00,390 --> 00:02:58,239
and towards totality

62
00:03:02,550 --> 00:03:00,400
great and i think um we have a really

63
00:03:04,550 --> 00:03:02,560

special telescope also we have a couple

64
00:03:06,949 --> 00:03:04,560
of those yeah yeah let's check it out so

65
00:03:08,869 --> 00:03:06,959
we have the full disc h alpha telescope

66
00:03:11,190 --> 00:03:08,879
as well and this is a very narrow filter

67
00:03:12,710 --> 00:03:11,200
so rather than like the eclipse glasses

68
00:03:15,350 --> 00:03:12,720
the white light filter

69
00:03:17,190 --> 00:03:15,360
it attenuates all of the light except

70
00:03:18,710 --> 00:03:17,200
for one very specific wavelength and

71
00:03:20,550 --> 00:03:18,720
that allows us to see the ionized

72
00:03:22,309 --> 00:03:20,560
hydrogen in the chromosphere so we can

73
00:03:24,309 --> 00:03:22,319
see these really neat flame-like

74
00:03:26,789 --> 00:03:24,319
structures the prominence flares

75
00:03:28,470 --> 00:03:26,799
filaments all those good things so cool

76
00:03:32,630 --> 00:03:28,480
and i think you have a close uh a couple

77
00:03:34,390 --> 00:03:32,640
of close-up cams too we do

78
00:03:36,390 --> 00:03:34,400
these are longer focal length versions

79
00:03:38,630 --> 00:03:36,400
the hydrogen alpha which allows us to

80
00:03:41,430 --> 00:03:38,640
see the close-up images in a little bit

81
00:03:43,110 --> 00:03:41,440
more detail of the prominence and the

82
00:03:44,550 --> 00:03:43,120
filaments and all those good things and

83
00:03:48,229 --> 00:03:44,560
the white light as well so we can see

84
00:03:51,589 --> 00:03:48,239
the spots in a little bit more detail

85
00:03:53,350 --> 00:03:51,599
great bill i just want to mention

86
00:03:55,750 --> 00:03:53,360
while we're here that white light

87
00:03:57,350 --> 00:03:55,760
telescope when you see that image it's

88
00:04:00,789 --> 00:03:57,360

the most similar to what we would see

89
00:04:03,030 --> 00:04:00,799
with our own naked eye i have a pair of

90
00:04:05,509 --> 00:04:03,040
uh safe viewing glasses here and if i

91
00:04:08,309 --> 00:04:05,519
put them on and if i look up at the sun

92
00:04:10,149 --> 00:04:08,319
what i'm seeing is very similar to that

93
00:04:11,910 --> 00:04:10,159
white light image so when you see that

94
00:04:13,670 --> 00:04:11,920
one you should be thinking that's what

95
00:04:15,030 --> 00:04:13,680
you see if you were here

96
00:04:16,870 --> 00:04:15,040
so next i want to talk about the

97
00:04:19,030 --> 00:04:16,880
alignment overhead so i wanted to

98
00:04:21,749 --> 00:04:19,040
introduce to you the senior scientist

99
00:04:23,990 --> 00:04:21,759
from the exploratorium dr paul doherty

100
00:04:25,909 --> 00:04:24,000
hi robin hi paul good to be here it's

101
00:04:28,710 --> 00:04:25,919
amazing to be here in micronesia isn't

102
00:04:30,310 --> 00:04:28,720
it it is and it's beginning to get dim

103
00:04:31,909 --> 00:04:30,320
it is actually the light's already

104
00:04:33,749 --> 00:04:31,919
changed a little bit

105
00:04:35,749 --> 00:04:33,759
it's noticeable here that the light's

106
00:04:37,430 --> 00:04:35,759
dimming it's getting darker i imagine

107
00:04:39,670 --> 00:04:37,440
over the next i don't know half an hour

108
00:04:41,110 --> 00:04:39,680
it's going to get really dramatic

109
00:04:43,110 --> 00:04:41,120
but let's talk about what's happening

110
00:04:45,830 --> 00:04:43,120
what's going over our on over our heads

111
00:04:47,909 --> 00:04:45,840
today the moon is moving on a line

112
00:04:49,430 --> 00:04:47,919
between the earth and the sun blocking

113
00:04:51,909 --> 00:04:49,440

our view of the sun and casting its

114
00:04:53,670 --> 00:04:51,919
shadow here on willy eye okay let's give

115
00:04:57,590 --> 00:04:53,680
people a better picture of what's going

116
00:04:59,189 --> 00:04:57,600
on so i have some tools here to help us

117
00:05:01,670 --> 00:04:59,199
okay so here's the earth if you hold the

118
00:05:04,390 --> 00:05:01,680
earth and i'll put the moon

119
00:05:06,790 --> 00:05:04,400
this is not to scale in its orbit

120
00:05:09,189 --> 00:05:06,800
and we have nasa scientists troy cline

121
00:05:11,270 --> 00:05:09,199
as the earth as the sun

122
00:05:13,110 --> 00:05:11,280
well as the moon orbits

123
00:05:15,110 --> 00:05:13,120
it can come in its orbit directly

124
00:05:17,029 --> 00:05:15,120
between the earth and the sun blocking

125
00:05:18,390 --> 00:05:17,039
our view of the sun casting a shadow on

126
00:05:19,590 --> 00:05:18,400
the earth and making a total solar

127
00:05:21,670 --> 00:05:19,600
eclipse

128
00:05:23,830 --> 00:05:21,680
okay paul

129
00:05:26,870 --> 00:05:23,840
i happen to know that that moon goes

130
00:05:28,230 --> 00:05:26,880
around the earth every 28 days so why is

131
00:05:30,230 --> 00:05:28,240
it that we don't get an eclipse every

132
00:05:33,189 --> 00:05:30,240
month well it turns out the moon's orbit

133
00:05:36,310 --> 00:05:33,199
is actually tilted about 5 degrees about

134
00:05:38,390 --> 00:05:36,320
10 lunar angular diameters so that

135
00:05:40,629 --> 00:05:38,400
in last december when i've set this up

136
00:05:43,749 --> 00:05:40,639
to represent the moon passes quite a

137
00:05:45,990 --> 00:05:43,759
ways above the earth sun line and the

138
00:05:47,830 --> 00:05:46,000

shadow misses i see so

139
00:05:49,749 --> 00:05:47,840
it's march now how come we're getting an

140
00:05:51,510 --> 00:05:49,759
eclipse well let's go from december here

141
00:05:52,469 --> 00:05:51,520
to march okay so we'll let the earth

142
00:05:56,070 --> 00:05:52,479
orbit

143
00:05:58,309 --> 00:05:56,080
three months into the future that's

144
00:06:00,550 --> 00:05:58,319
right here we are in march and wooly eye

145
00:06:02,550 --> 00:06:00,560
and the moon's orbit has remained in its

146
00:06:04,790 --> 00:06:02,560
same orientation

147
00:06:08,150 --> 00:06:04,800
so that now when the moon goes around in

148
00:06:10,950 --> 00:06:08,160
its orbit as it crosses the plane of the

149
00:06:13,430 --> 00:06:10,960
earth's orbit it blocks the sun so now

150
00:06:15,749 --> 00:06:13,440
we can have that total solar eclipse in

151
00:06:17,430 --> 00:06:15,759
march gotcha and i guess if i think

152
00:06:19,990 --> 00:06:17,440
about that i know that the earth goes

153
00:06:21,670 --> 00:06:20,000
all the way around the sun in a year so

154
00:06:23,909 --> 00:06:21,680
there might be another chance for an

155
00:06:25,830 --> 00:06:23,919
eclipse right in six months we'll be on

156
00:06:28,150 --> 00:06:25,840
the exact other side of the sun and the

157
00:06:29,909 --> 00:06:28,160
moon would pass through the plane

158
00:06:31,430 --> 00:06:29,919
perhaps at the right time the timing has

159
00:06:33,590 --> 00:06:31,440
to be right to actually make a total

160
00:06:35,350 --> 00:06:33,600
solar eclipse gotcha so there's there's

161
00:06:38,629 --> 00:06:35,360
sort of two chances to see an eclipse

162
00:06:40,309 --> 00:06:38,639
everywhere two solar eclipse seasons per

163
00:06:41,909 --> 00:06:40,319

year and we don't have a total solar

164
00:06:43,909 --> 00:06:41,919
eclipse every season the timing has to

165
00:06:45,909 --> 00:06:43,919
be right okay i hear some cheering in

166
00:06:47,909 --> 00:06:45,919
the crowd which makes me think we should

167
00:06:49,749 --> 00:06:47,919
check out the telescopes so let's take a

168
00:06:51,350 --> 00:06:49,759
look

169
00:06:52,390 --> 00:06:51,360
okay

170
00:06:53,909 --> 00:06:52,400
so

171
00:06:56,150 --> 00:06:53,919
i'm seeing a

172
00:06:58,230 --> 00:06:56,160
little bit of cloud cover so i guess

173
00:06:59,990 --> 00:06:58,240
that's what they were saying about is we

174
00:07:02,390 --> 00:07:00,000
have some clouds so our telescopes have

175
00:07:05,430 --> 00:07:02,400
gone dark when i look up overhead i do

176
00:07:07,670 --> 00:07:05,440
indeed see a big black cloud but i also

177
00:07:09,430 --> 00:07:07,680
see blue off into the distance so i have

178
00:07:11,270 --> 00:07:09,440
a feeling that i don't know you want to

179
00:07:13,189 --> 00:07:11,280
call that paul 10 15 minutes we'll get

180
00:07:14,790 --> 00:07:13,199
blue skies again the clouds are moving

181
00:07:16,070 --> 00:07:14,800
really quickly i think it'll be sooner

182
00:07:17,670 --> 00:07:16,080
than that all right we'll get our view

183
00:07:18,790 --> 00:07:17,680
back well that sounds awesome in the

184
00:07:20,469 --> 00:07:18,800
meantime

185
00:07:22,629 --> 00:07:20,479
let's talk about what else is going on

186
00:07:25,270 --> 00:07:22,639
so i get that from here when i look up

187
00:07:27,430 --> 00:07:25,280
in the sky the moon is blocking my view

188
00:07:28,870 --> 00:07:27,440

but if i was in space and looking down

189
00:07:30,629 --> 00:07:28,880
at the earth some i'd see something

190
00:07:33,990 --> 00:07:30,639
different right we have a video to show

191
00:07:35,990 --> 00:07:34,000
you which we show the moon

192
00:07:37,990 --> 00:07:36,000
in this animation moving between the sun

193
00:07:39,670 --> 00:07:38,000
and the earth we in this animation we

194
00:07:41,749 --> 00:07:39,680
let you see the shadow of the moon which

195
00:07:43,749 --> 00:07:41,759
you'd never see in the vacuum of space

196
00:07:46,390 --> 00:07:43,759
and you can see how it tapers down to

197
00:07:47,670 --> 00:07:46,400
hit a spot on the earth where we'll be

198
00:07:49,510 --> 00:07:47,680
standing

199
00:07:52,550 --> 00:07:49,520
i see so there's that big shadow and

200
00:07:54,950 --> 00:07:52,560
it's actually moving

201
00:07:57,749 --> 00:07:54,960
you know it's strange to think about the

202
00:07:59,189 --> 00:07:57,759
moon casting a shadow on the earth

203
00:08:01,430 --> 00:07:59,199
i wonder what that would look like well

204
00:08:04,550 --> 00:08:01,440
if we back up into space yeah for the

205
00:08:06,629 --> 00:08:04,560
eclipse of 2006 over africa here's a

206
00:08:08,710 --> 00:08:06,639
photo from a spacecraft and you can see

207
00:08:11,029 --> 00:08:08,720
the shadow of the moon in the sahara

208
00:08:12,710 --> 00:08:11,039
desert wow it's actually smaller than i

209
00:08:15,270 --> 00:08:12,720
would imagine oh yeah in fact the

210
00:08:18,869 --> 00:08:15,280
darkest part the totality is always less

211
00:08:20,070 --> 00:08:18,879
than 107 miles across oh very cool

212
00:08:21,909 --> 00:08:20,080
so um

213
00:08:23,749 --> 00:08:21,919

let's talk a little bit about why we're

214
00:08:24,830 --> 00:08:23,759
here in woolie today

215
00:08:27,670 --> 00:08:24,840
so the

216
00:08:30,070 --> 00:08:27,680
earth is getting a shadow cast on it

217
00:08:31,350 --> 00:08:30,080
from the moon that's right and the earth

218
00:08:33,350 --> 00:08:31,360
is rotating

219
00:08:35,509 --> 00:08:33,360
and the moon is moving in its orbit and

220
00:08:37,829 --> 00:08:35,519
that combination of motions

221
00:08:41,190 --> 00:08:37,839
leads to the shadows

222
00:08:42,550 --> 00:08:41,200
sweeping across on the path of totality

223
00:08:44,550 --> 00:08:42,560
and here we see

224
00:08:47,670 --> 00:08:44,560
partial eclipses these lines represent

225
00:08:49,910 --> 00:08:47,680
partial eclipses but then the red band

226
00:08:53,190 --> 00:08:49,920
is total solar eclipse sweeping across

227
00:08:55,350 --> 00:08:53,200
borneo indonesia heading up towards us

228
00:08:57,910 --> 00:08:55,360
in william etal so you need to be in

229
00:08:59,430 --> 00:08:57,920
that red line to get totality that's

230
00:09:01,509 --> 00:08:59,440
correct that's correct okay and here it

231
00:09:05,110 --> 00:09:01,519
is sweeping across wooly eye and on

232
00:09:07,110 --> 00:09:05,120
across the pacific that's where we are

233
00:09:10,070 --> 00:09:07,120
so if you notice on this path a lot of

234
00:09:13,030 --> 00:09:10,080
that path of totality is on water

235
00:09:14,630 --> 00:09:13,040
and we need actually firm ground in

236
00:09:17,110 --> 00:09:14,640
order for our telescopes to send back

237
00:09:20,310 --> 00:09:17,120
the best images so so that sort of talks

238
00:09:22,949 --> 00:09:20,320

about uh why we're here in woolie that's

239
00:09:24,870 --> 00:09:22,959
right and in fact these bands on either

240
00:09:26,949 --> 00:09:24,880
side represent the degree of partial

241
00:09:29,030 --> 00:09:26,959
solar eclipse you can see so you can see

242
00:09:31,269 --> 00:09:29,040
that from the philippines down to

243
00:09:33,990 --> 00:09:31,279
australia people are seeing partial

244
00:09:36,150 --> 00:09:34,000
solar eclipses right and here today

245
00:09:37,430 --> 00:09:36,160
we're not quite seeing anything yet but

246
00:09:38,790 --> 00:09:37,440
very soon

247
00:09:40,550 --> 00:09:38,800
but i'd like to talk about the journey

248
00:09:42,870 --> 00:09:40,560
to get here wooly eye's an

249
00:09:45,990 --> 00:09:42,880
awfully remote place so our crew

250
00:09:48,310 --> 00:09:46,000
actually spent 22 hours it was a three

251
00:09:52,310 --> 00:09:48,320
airplane journey to get here until we

252
00:09:55,030 --> 00:09:52,320
arrived in yap um colonial uh colonia is

253
00:09:57,430 --> 00:09:55,040
the uh capital of yap where we boarded a

254
00:09:59,509 --> 00:09:57,440
liveaboard boat called the solitude one

255
00:10:02,069 --> 00:09:59,519
we spent about two days crossing the

256
00:10:05,350 --> 00:10:02,079
open ocean and it was pretty bumpy we

257
00:10:07,110 --> 00:10:05,360
got a little bit green until we got here

258
00:10:09,829 --> 00:10:07,120
to the wooly eye atoll

259
00:10:12,470 --> 00:10:09,839
our first thing that we needed to do was

260
00:10:14,389 --> 00:10:12,480
to come ashore and sort of scout around

261
00:10:16,790 --> 00:10:14,399
where was the best place for us to put

262
00:10:19,110 --> 00:10:16,800
our telescopes our satellite dish where

263
00:10:21,990 --> 00:10:19,120

we get the best images and we picked the

264
00:10:24,790 --> 00:10:22,000
runway it's an old world war ii runway

265
00:10:26,710 --> 00:10:24,800
and then the next step of course was

266
00:10:29,430 --> 00:10:26,720
bringing all of that gear

267
00:10:32,790 --> 00:10:29,440
onto shore we actually have about 56

268
00:10:34,790 --> 00:10:32,800
cases of gear about two tons we need to

269
00:10:37,750 --> 00:10:34,800
bring it here to the runway

270
00:10:40,310 --> 00:10:37,760
unpack it all get it set up we had

271
00:10:41,910 --> 00:10:40,320
cameras to set up we had a lot of cords

272
00:10:43,990 --> 00:10:41,920
to plug in

273
00:10:45,430 --> 00:10:44,000
the satellite people had to tune the

274
00:10:47,670 --> 00:10:45,440
satellite and make sure that they could

275
00:10:50,550 --> 00:10:47,680
hit the bird up in the sky

276
00:10:53,030 --> 00:10:50,560
we had telescopes to get into place bill

277
00:10:56,550 --> 00:10:53,040
spent a lot of time aligning those

278
00:10:58,630 --> 00:10:56,560
telescopes night after night after night

279
00:11:00,949 --> 00:10:58,640
but we finally had it all worked out we

280
00:11:03,430 --> 00:11:00,959
had everything sort of in place which

281
00:11:05,509 --> 00:11:03,440
then for the next few days uh gave us an

282
00:11:07,430 --> 00:11:05,519
opportunity to sort of rehearse this to

283
00:11:09,670 --> 00:11:07,440
think about what we wanted to do but it

284
00:11:12,550 --> 00:11:09,680
also gave us an opportunity to spend a

285
00:11:15,030 --> 00:11:12,560
little bit more time checking out the

286
00:11:17,750 --> 00:11:15,040
wooly eye at toll it's an incredibly

287
00:11:20,470 --> 00:11:17,760
incredibly beautiful spot

288
00:11:22,550 --> 00:11:20,480

a beautiful blue lagoon palm trees and

289
00:11:24,790 --> 00:11:22,560
breadfruit trees

290
00:11:26,710 --> 00:11:24,800
um the people here live a quite a

291
00:11:28,630 --> 00:11:26,720
traditional lifestyle they live in

292
00:11:30,150 --> 00:11:28,640
traditional longhouses

293
00:11:32,550 --> 00:11:30,160
and here i'd say these are some of the

294
00:11:35,030 --> 00:11:32,560
chiefs there's two chiefs here on the

295
00:11:37,670 --> 00:11:35,040
woolie atoll we met with them we

296
00:11:40,389 --> 00:11:37,680
formally asked permission to be here

297
00:11:42,230 --> 00:11:40,399
they were so kind and so welcoming they

298
00:11:43,590 --> 00:11:42,240
offered to host us and give us whatever

299
00:11:45,430 --> 00:11:43,600
support we needed

300
00:11:47,350 --> 00:11:45,440
the local folks too

301
00:11:49,509 --> 00:11:47,360
were so gracious they offered us

302
00:11:51,829 --> 00:11:49,519
coconuts to keep us hydrated they

303
00:11:53,509 --> 00:11:51,839
offered us food i spent a little time in

304
00:11:54,790 --> 00:11:53,519
the women's longhouse as they were

305
00:11:57,829 --> 00:11:54,800
preparing

306
00:12:00,230 --> 00:11:57,839
food again mostly taro and breadfruit

307
00:12:02,629 --> 00:12:00,240
we wrapped them up in

308
00:12:04,470 --> 00:12:02,639
in leaves banana leaves i asked the

309
00:12:06,710 --> 00:12:04,480
ladies why they're making so much food

310
00:12:08,949 --> 00:12:06,720
they were just piles and piles big

311
00:12:10,710 --> 00:12:08,959
baskets of food and they said it was

312
00:12:12,710 --> 00:12:10,720
because as their tradition it says they

313
00:12:14,470 --> 00:12:12,720

needed to feed everyone who's coming

314
00:12:16,470 --> 00:12:14,480
here and we have quite a few eclipse

315
00:12:18,150 --> 00:12:16,480
chasers on the island with us people

316
00:12:20,150 --> 00:12:18,160
from all over the world have come here

317
00:12:22,550 --> 00:12:20,160
to witness the eclipse as well as a lot

318
00:12:23,990 --> 00:12:22,560
of people from the outer islands

319
00:12:26,150 --> 00:12:24,000
what you're seeing now is some of the

320
00:12:28,470 --> 00:12:26,160
weaving you'll notice when you get here

321
00:12:29,990 --> 00:12:28,480
everything's woven side panels of the

322
00:12:31,590 --> 00:12:30,000
longhouses

323
00:12:33,829 --> 00:12:31,600
baskets

324
00:12:36,150 --> 00:12:33,839
it's a beautiful place

325
00:12:38,949 --> 00:12:36,160
it really is and we taught the students

326
00:12:41,430 --> 00:12:38,959
here how to observe the eclipse safely

327
00:12:43,509 --> 00:12:41,440
what to look for during totality

328
00:12:46,310 --> 00:12:43,519
they were amazing they were really

329
00:12:48,870 --> 00:12:46,320
interested we gave them all safe viewing

330
00:12:50,550 --> 00:12:48,880
glasses and here's a kid just really

331
00:12:52,150 --> 00:12:50,560
smiling and enjoying looking at the sun

332
00:12:54,150 --> 00:12:52,160
yesterday i know we've been so

333
00:12:55,350 --> 00:12:54,160
enthusiastically received by the local

334
00:12:57,190 --> 00:12:55,360
people here and it's been such a

335
00:12:59,430 --> 00:12:57,200
privilege to be able to share what we

336
00:13:00,310 --> 00:12:59,440
know one of the local women actually

337
00:13:02,470 --> 00:13:00,320
said

338
00:13:04,069 --> 00:13:02,480

that during a previous eclipse

339
00:13:05,590 --> 00:13:04,079
they didn't know it was going to happen

340
00:13:07,670 --> 00:13:05,600
so they actually gathered their friends

341
00:13:09,190 --> 00:13:07,680
and families and they went indoors to

342
00:13:11,430 --> 00:13:09,200
hide from the eclipse because i didn't

343
00:13:12,790 --> 00:13:11,440
know what was happening so it's it's so

344
00:13:14,389 --> 00:13:12,800
great this time that we've been able to

345
00:13:16,069 --> 00:13:14,399
share with them what's going on and

346
00:13:18,629 --> 00:13:16,079
they're all out here on the runway with

347
00:13:20,230 --> 00:13:18,639
us today to experience this

348
00:13:21,670 --> 00:13:20,240
yeah in fact i hopefully we have a

349
00:13:23,990 --> 00:13:21,680
little hole here in the clouds and we

350
00:13:25,509 --> 00:13:24,000
can go to the white light camera when it

351
00:13:27,430 --> 00:13:25,519
comes out okay

352
00:13:28,870 --> 00:13:27,440
and well

353
00:13:31,350 --> 00:13:28,880
so i guess we do have clouds it's sort

354
00:13:33,269 --> 00:13:31,360
of peeping in and out so um it's a

355
00:13:34,870 --> 00:13:33,279
little dark right now we're getting some

356
00:13:37,990 --> 00:13:34,880
good peeps there for a minute but

357
00:13:39,910 --> 00:13:38,000
they've kind of disappeared now so paul

358
00:13:41,189 --> 00:13:39,920
i have to say the last few days we've

359
00:13:42,870 --> 00:13:41,199
been spending a lot of time with

360
00:13:43,750 --> 00:13:42,880
building the telescopes checking out the

361
00:13:46,470 --> 00:13:43,760
sun

362
00:13:47,990 --> 00:13:46,480
seeing what's going on and it leads me

363
00:13:49,590 --> 00:13:48,000

to ask you

364
00:13:52,310 --> 00:13:49,600
what is the sun again

365
00:13:54,150 --> 00:13:52,320
so the sun is a star and at the core

366
00:13:56,389 --> 00:13:54,160
the pressure and temperature

367
00:13:58,310 --> 00:13:56,399
bring together hydrogens convert them

368
00:14:00,790 --> 00:13:58,320
into heliums with a loss of mass which

369
00:14:02,470 --> 00:14:00,800
turns into energy which leak comes out

370
00:14:04,470 --> 00:14:02,480
from the center of the core out to the

371
00:14:06,550 --> 00:14:04,480
outer layers of the sun where the light

372
00:14:08,470 --> 00:14:06,560
leaps free into space from the layer

373
00:14:09,829 --> 00:14:08,480
called the photosphere that's the part

374
00:14:12,069 --> 00:14:09,839
of the sun that we see

375
00:14:14,069 --> 00:14:12,079
right okay so

376
00:14:15,590 --> 00:14:14,079
we want to talk a little bit about the

377
00:14:16,550 --> 00:14:15,600
layers of sun that we're going to see

378
00:14:18,310 --> 00:14:16,560
today

379
00:14:20,150 --> 00:14:18,320
so the first layer the one that we kind

380
00:14:21,670 --> 00:14:20,160
of see with our naked eye if we were to

381
00:14:23,030 --> 00:14:21,680
glance at the sun which you should never

382
00:14:24,710 --> 00:14:23,040
do

383
00:14:25,990 --> 00:14:24,720
is the photosphere so let's take a look

384
00:14:28,790 --> 00:14:26,000
at that i think we're getting a little

385
00:14:30,710 --> 00:14:28,800
clarity here so this is is this a white

386
00:14:32,550 --> 00:14:30,720
light image this looks like a hydrogen

387
00:14:35,030 --> 00:14:32,560
alpha oh there we go

388
00:14:37,350 --> 00:14:35,040

so there we are we see a few sun spots

389
00:14:39,670 --> 00:14:37,360
is that true on the sun um those may be

390
00:14:41,670 --> 00:14:39,680
uh filaments but they may be sunspots

391
00:14:43,829 --> 00:14:41,680
okay fair enough so what we're seeing

392
00:14:45,269 --> 00:14:43,839
filaments they're filaments this is a

393
00:14:48,150 --> 00:14:45,279
hydrogen alpha filter we're seeing and

394
00:14:50,150 --> 00:14:48,160
there's a prominence on the top there

395
00:14:52,790 --> 00:14:50,160
okay so the um

396
00:14:54,310 --> 00:14:52,800
the the hydrogen alpha filter is showing

397
00:14:56,230 --> 00:14:54,320
us a certain layer of the sun right

398
00:14:58,310 --> 00:14:56,240
above the photosphere there's a layer

399
00:15:00,629 --> 00:14:58,320
called the chromosphere and you'll see

400
00:15:03,110 --> 00:15:00,639
that during totality as a little thin

401
00:15:04,470 --> 00:15:03,120
pink to red layer

402
00:15:05,910 --> 00:15:04,480
around the edge of the moon on the sun

403
00:15:07,269 --> 00:15:05,920
part part of the time right and one of

404
00:15:08,790 --> 00:15:07,279
the things i love about the photosphere

405
00:15:10,870 --> 00:15:08,800
is it's so active there's a lot of

406
00:15:13,350 --> 00:15:10,880
activity happening there including we

407
00:15:15,030 --> 00:15:13,360
sometimes see little prominences on the

408
00:15:16,550 --> 00:15:15,040
edge of the sun i'm not sure if we're

409
00:15:18,949 --> 00:15:16,560
seeing any today

410
00:15:21,030 --> 00:15:18,959
oh yeah take a look let's take a look so

411
00:15:23,030 --> 00:15:21,040
here we have the the photosphere view

412
00:15:24,870 --> 00:15:23,040
it's a oh no that's that's still the

413
00:15:26,389 --> 00:15:24,880

that's still the hydrogen alpha

414
00:15:27,829 --> 00:15:26,399
okay we're taking a look at the hydrogen

415
00:15:29,110 --> 00:15:27,839
alpha thing with the clouds coming in

416
00:15:30,949 --> 00:15:29,120
and out we have to adjust the gain on

417
00:15:33,269 --> 00:15:30,959
the telescopes all the time so it's a

418
00:15:35,350 --> 00:15:33,279
dynamic process oh but there is a

419
00:15:37,269 --> 00:15:35,360
wonderful prominence wow that really

420
00:15:39,430 --> 00:15:37,279
shows up in that hydrogen holy smoke

421
00:15:41,749 --> 00:15:39,440
there is a giant prominence right at the

422
00:15:43,430 --> 00:15:41,759
top of your image of the sun it's going

423
00:15:45,910 --> 00:15:43,440
out a little in and out because of the

424
00:15:47,670 --> 00:15:45,920
clouds but that's absolutely gorgeous

425
00:15:49,590 --> 00:15:47,680
paul so what's going on there

426
00:15:52,230 --> 00:15:49,600
well the sun

427
00:15:53,990 --> 00:15:52,240
is a really rich in magnetic fields not

428
00:15:55,829 --> 00:15:54,000
only an overall magnetic field but there

429
00:15:57,269 --> 00:15:55,839
are magnetic fields that twist up and

430
00:16:00,710 --> 00:15:57,279
penetrate through the surface making

431
00:16:03,110 --> 00:16:00,720
sunspots and guiding in advance the

432
00:16:04,790 --> 00:16:03,120
charged particles that make up the sun

433
00:16:07,110 --> 00:16:04,800
so the charged particles move along the

434
00:16:08,710 --> 00:16:07,120
magnetic field lines and as they move

435
00:16:12,230 --> 00:16:08,720
they change the magnetic field lines

436
00:16:14,150 --> 00:16:12,240
this is amazing dance and the result is

437
00:16:16,069 --> 00:16:14,160
charged particles from the sun reaching

438
00:16:17,829 --> 00:16:16,079

out into space going out from the

439
00:16:19,590 --> 00:16:17,839
photosphere through the chromosphere out

440
00:16:20,389 --> 00:16:19,600
into the corona the next layer of the

441
00:16:22,870 --> 00:16:20,399
sun

442
00:16:24,949 --> 00:16:22,880
and that prominence is quite a bit

443
00:16:26,550 --> 00:16:24,959
larger than the earth

444
00:16:28,230 --> 00:16:26,560
yeah that's incredible in fact i'm not

445
00:16:30,470 --> 00:16:28,240
sure i've ever seen a prominence that

446
00:16:32,710 --> 00:16:30,480
large before it is really really

447
00:16:34,870 --> 00:16:32,720
incredibly beautiful so i think that we

448
00:16:36,710 --> 00:16:34,880
actually have an animation that shows i

449
00:16:38,310 --> 00:16:36,720
hate to break away from this but it it

450
00:16:39,749 --> 00:16:38,320
shows some of the active activity from

451
00:16:41,829 --> 00:16:39,759
one of the satellites we can see a lot

452
00:16:43,990 --> 00:16:41,839
of detail so let's run that really quick

453
00:16:46,550 --> 00:16:44,000
so we have a satellite view of the sun

454
00:16:48,389 --> 00:16:46,560
the sun takes about an earth month to

455
00:16:50,150 --> 00:16:48,399
rotate once so this is quite a bit sped

456
00:16:51,590 --> 00:16:50,160
up

457
00:16:54,629 --> 00:16:51,600
and

458
00:16:56,710 --> 00:16:54,639
it just reminds us that sunspots are

459
00:16:58,870 --> 00:16:56,720
magnetic storms on the sun whenever you

460
00:17:01,269 --> 00:16:58,880
see a sunspot think magnetic fields

461
00:17:03,269 --> 00:17:01,279
coming out of that sunspot going back

462
00:17:05,429 --> 00:17:03,279
down into the sun and it is pretty

463
00:17:07,669 --> 00:17:05,439

incredible again to see the sun like

464
00:17:09,429 --> 00:17:07,679
this we haven't seen this yet it's very

465
00:17:11,429 --> 00:17:09,439
active as you were saying it's moving

466
00:17:13,669 --> 00:17:11,439
around these magnetic fields

467
00:17:14,710 --> 00:17:13,679
in a giant ball that's absolutely

468
00:17:16,870 --> 00:17:14,720
gorgeous

469
00:17:18,710 --> 00:17:16,880
look at the amount of the sun that's

470
00:17:20,549 --> 00:17:18,720
covered by the moon now the eclipse is

471
00:17:22,710 --> 00:17:20,559
really progressing and it's getting

472
00:17:23,510 --> 00:17:22,720
quite dim here it is getting quite dim

473
00:17:26,150 --> 00:17:23,520
here

474
00:17:28,309 --> 00:17:26,160
so uh during the eclipse we've talked a

475
00:17:29,830 --> 00:17:28,319
little bit about the photosphere right

476
00:17:31,350 --> 00:17:29,840
which is the part that you kind of would

477
00:17:33,029 --> 00:17:31,360
see with your eye if you were to look at

478
00:17:34,950 --> 00:17:33,039
it and then we talked about the next

479
00:17:36,870 --> 00:17:34,960
layer out which is the chromosphere that

480
00:17:38,710 --> 00:17:36,880
sometimes appears pinks we're sort of we

481
00:17:40,870 --> 00:17:38,720
think of those prominences living but

482
00:17:42,710 --> 00:17:40,880
they reach out into the outermost

483
00:17:45,430 --> 00:17:42,720
atmosphere of the sun that we call the

484
00:17:46,630 --> 00:17:45,440
corona so um why don't you tell me a

485
00:17:49,510 --> 00:17:46,640
little bit about the corona so the

486
00:17:51,830 --> 00:17:49,520
corona is the sun's outer atmosphere the

487
00:17:55,110 --> 00:17:51,840
gas in the corona is millions of degrees

488
00:17:57,270 --> 00:17:55,120

and it glows with this dim white glow

489
00:17:59,430 --> 00:17:57,280
the corona is one thing you can see with

490
00:18:01,909 --> 00:17:59,440
your naked eye when the photosphere is

491
00:18:05,190 --> 00:18:01,919
blocked by a total solar eclipse

492
00:18:07,590 --> 00:18:05,200
so it's just just it's the great treat

493
00:18:09,669 --> 00:18:07,600
of totality is to see that corona as a

494
00:18:12,789 --> 00:18:09,679
white series of lines guided by

495
00:18:14,549 --> 00:18:12,799
magnetism out into space yep and the

496
00:18:15,830 --> 00:18:14,559
corona today we actually have no idea

497
00:18:17,669 --> 00:18:15,840
what it's going to look like right it's

498
00:18:19,270 --> 00:18:17,679
going to be a surprise to us well you

499
00:18:21,270 --> 00:18:19,280
know scientists have predicted that

500
00:18:23,430 --> 00:18:21,280
they'll be like four lobes of the corona

501
00:18:26,390 --> 00:18:23,440
so we're going to check our actual view

502
00:18:27,990 --> 00:18:26,400
of the corona uh with with the real with

503
00:18:30,070 --> 00:18:28,000
the with the prediction right but like

504
00:18:32,470 --> 00:18:30,080
the other parts of the sun it's magnetic

505
00:18:34,630 --> 00:18:32,480
and it reacts to this magnetism so it's

506
00:18:36,230 --> 00:18:34,640
moving and changing so

507
00:18:38,310 --> 00:18:36,240
it might not be a correct prediction

508
00:18:39,510 --> 00:18:38,320
we'll find out you know scientists you

509
00:18:41,430 --> 00:18:39,520
stake your reputation on your

510
00:18:43,909 --> 00:18:41,440
predictions and then you test them

511
00:18:45,510 --> 00:18:43,919
okay so um while we're waiting let's

512
00:18:47,190 --> 00:18:45,520
take a look at the sun

513
00:18:49,510 --> 00:18:47,200

we're again seeing this i believe that's

514
00:18:51,669 --> 00:18:49,520
the h alpha view and that beautiful

515
00:18:54,630 --> 00:18:51,679
prominence you can see how large it is

516
00:18:57,029 --> 00:18:54,640
paul could you take a stab at exactly

517
00:18:59,350 --> 00:18:57,039
how big that is i'd say that's at least

518
00:19:01,590 --> 00:18:59,360
five earth diameters on the bright part

519
00:19:04,470 --> 00:19:01,600
and the dimmer parts reach out beyond

520
00:19:06,070 --> 00:19:04,480
10 earth diameters great so actually

521
00:19:07,590 --> 00:19:06,080
while this image is great we have

522
00:19:09,669 --> 00:19:07,600
another image that was taken from a

523
00:19:11,270 --> 00:19:09,679
satellite so we can see a prominence a

524
00:19:13,270 --> 00:19:11,280
little bit closer up yeah the clouds are

525
00:19:15,270 --> 00:19:13,280
about to obliterate our actual view so

526
00:19:16,470 --> 00:19:15,280
let's take a look at a prominence from

527
00:19:19,270 --> 00:19:16,480
the past

528
00:19:21,190 --> 00:19:19,280
and you can see that uh reaching way out

529
00:19:23,270 --> 00:19:21,200
from the sun that's right so that's in

530
00:19:27,669 --> 00:19:23,280
the upper sort of upper right of this

531
00:19:32,789 --> 00:19:30,710
and those prominences are alive they're

532
00:19:33,669 --> 00:19:32,799
in action with the magnetic fields of

533
00:19:35,350 --> 00:19:33,679
the sun

534
00:19:37,669 --> 00:19:35,360
guiding those charged particles out and

535
00:19:39,190 --> 00:19:37,679
sometimes back in to the sun and there's

536
00:19:41,430 --> 00:19:39,200
the earth to scale right so here you can

537
00:19:43,190 --> 00:19:41,440
see exactly how large those prominences

538
00:19:44,710 --> 00:19:43,200

they're gigantic

539
00:19:46,549 --> 00:19:44,720
and very beautiful

540
00:19:50,470 --> 00:19:46,559
they are that i mean i just love that

541
00:19:56,710 --> 00:19:51,270
so

542
00:19:59,590 --> 00:19:56,720
break free of the sun as we're going to

543
00:20:02,630 --> 00:19:59,600
show you here as coronal mass ejections

544
00:20:04,470 --> 00:20:02,640
which are also sketched in in the 1800s

545
00:20:05,909 --> 00:20:04,480
during a total solar eclipse and so if

546
00:20:06,950 --> 00:20:05,919
you look at this

547
00:20:10,950 --> 00:20:06,960
nasa

548
00:20:12,950 --> 00:20:10,960
satellite images of the sun you can see

549
00:20:15,270 --> 00:20:12,960
giant clouds of

550
00:20:16,710 --> 00:20:15,280
ionized gas blasting out from the sun

551
00:20:18,870 --> 00:20:16,720
into space

552
00:20:21,830 --> 00:20:18,880
as they continue out

553
00:20:23,510 --> 00:20:21,840
those blasts can actually

554
00:20:25,110 --> 00:20:23,520
hit the earth

555
00:20:27,669 --> 00:20:25,120
oh i see what you're saying so these

556
00:20:30,470 --> 00:20:27,679
gigantic explosions on the sun

557
00:20:32,630 --> 00:20:30,480
are blasting particles at us

558
00:20:35,110 --> 00:20:32,640
and those impact the earth and that

559
00:20:36,789 --> 00:20:35,120
makes me think that that's the hidden

560
00:20:38,870 --> 00:20:36,799
connection between the sun and the earth

561
00:20:42,470 --> 00:20:38,880
i was talking about before which means

562
00:20:45,909 --> 00:20:42,480
it's time for us to bring out troy klein

563
00:20:47,190 --> 00:20:45,919

from nasa he's an education technology

564
00:20:48,870 --> 00:20:47,200
specialist

565
00:20:50,630 --> 00:20:48,880
great to have you here thank you so much

566
00:20:51,990 --> 00:20:50,640
it's a pleasure to be here okay let's

567
00:20:53,350 --> 00:20:52,000
check in the telescopes i think we have

568
00:20:56,789 --> 00:20:53,360
a minute here a little break in the

569
00:20:59,029 --> 00:20:56,799
cloud so let's take a look at it

570
00:21:00,710 --> 00:20:59,039
wow

571
00:21:03,590 --> 00:21:00,720
could you fix it and get us the actual

572
00:21:04,549 --> 00:21:03,600
feed

573
00:21:06,870 --> 00:21:04,559
well

574
00:21:08,630 --> 00:21:06,880
troy what do you do at nasa i have a

575
00:21:10,630 --> 00:21:08,640
couple different jobs there i'm an

576
00:21:11,430 --> 00:21:10,640
education technology specialist and i'm

577
00:21:13,510 --> 00:21:11,440
also

578
00:21:15,029 --> 00:21:13,520
the education and public outreach lead

579
00:21:17,830 --> 00:21:15,039
for a mission that's called the

580
00:21:19,590 --> 00:21:17,840
magnetospheric multi-skill or mms

581
00:21:21,430 --> 00:21:19,600
mission i'm the mission education lead

582
00:21:22,549 --> 00:21:21,440
for them

583
00:21:23,510 --> 00:21:22,559
and and

584
00:21:26,230 --> 00:21:23,520
how

585
00:21:28,390 --> 00:21:26,240
does that help us understand the sun

586
00:21:30,549 --> 00:21:28,400
well you know nasa has quite a fleet of

587
00:21:32,310 --> 00:21:30,559
satellites right now that are up looking

588
00:21:34,230 --> 00:21:32,320

at the sun and the earth and something

589
00:21:36,149 --> 00:21:34,240
that we call solar storms and space

590
00:21:38,149 --> 00:21:36,159
weather because it's very important to

591
00:21:40,310 --> 00:21:38,159
us to know how to live with this star

592
00:21:42,470 --> 00:21:40,320
sun and as you've been talking about

593
00:21:45,510 --> 00:21:42,480
just earlier our sun is a magnet it's

594
00:21:47,830 --> 00:21:45,520
basically a giant magnetic force and it

595
00:21:49,750 --> 00:21:47,840
it has an equator that's moving quicker

596
00:21:52,310 --> 00:21:49,760
than the north and south poles can keep

597
00:21:55,029 --> 00:21:52,320
up and because of that those magnetic

598
00:21:57,029 --> 00:21:55,039
field lines get twisted and tangled and

599
00:21:59,110 --> 00:21:57,039
sometimes will create sun spots where

600
00:22:01,430 --> 00:21:59,120
the there's a high concentration of

601
00:22:03,270 --> 00:22:01,440
magnetic force now what we're going to

602
00:22:06,470 --> 00:22:03,280
see in just a moment is how that

603
00:22:08,390 --> 00:22:06,480
magnetic sun also interacts with our

604
00:22:11,590 --> 00:22:08,400
magnetic earth i have a great video if

605
00:22:13,830 --> 00:22:11,600
you'd like to see it let's show that

606
00:22:15,510 --> 00:22:13,840
looks like aurora to me oh it sure does

607
00:22:17,350 --> 00:22:15,520
have you seen it in aurora i have seen

608
00:22:19,430 --> 00:22:17,360
many it's the visual evidence that

609
00:22:20,950 --> 00:22:19,440
something is going on that started on

610
00:22:22,870 --> 00:22:20,960
the sun and we're seeing some magnetic

611
00:22:25,590 --> 00:22:22,880
field lines right now that are coming

612
00:22:27,190 --> 00:22:25,600
out of two areas that look like sunspots

613
00:22:29,990 --> 00:22:27,200

and when those magnetic field lines

614
00:22:31,830 --> 00:22:30,000
build up so much force though you'll

615
00:22:33,750 --> 00:22:31,840
notice that they start to stretch away

616
00:22:35,669 --> 00:22:33,760
from the sun and something very

617
00:22:37,350 --> 00:22:35,679
important begins to happen that is

618
00:22:39,430 --> 00:22:37,360
actually the trigger of our space

619
00:22:41,110 --> 00:22:39,440
weather events now as those field lines

620
00:22:43,909 --> 00:22:41,120
start to stretch and touch

621
00:22:46,789 --> 00:22:43,919
boom they connect and disconnect and it

622
00:22:49,669 --> 00:22:46,799
expels a tremendous amount of energy and

623
00:22:51,669 --> 00:22:49,679
plasma and ions away from the sun in

624
00:22:52,950 --> 00:22:51,679
various directions now the only time

625
00:22:55,029 --> 00:22:52,960
we're really worried about that of

626
00:22:57,110 --> 00:22:55,039
course is if it's headed towards earth

627
00:22:59,110 --> 00:22:57,120
or where we have humans in space and

628
00:23:01,669 --> 00:22:59,120
that can be very critical now we're

629
00:23:03,270 --> 00:23:01,679
looking at this plasma it takes usually

630
00:23:05,510 --> 00:23:03,280
about three or four days for the main

631
00:23:07,750 --> 00:23:05,520
effects of this to hit us but the earth

632
00:23:10,230 --> 00:23:07,760
is just amazing and it's designed

633
00:23:12,390 --> 00:23:10,240
beautifully it has an invisible magnetic

634
00:23:14,390 --> 00:23:12,400
force field that surrounds the entire

635
00:23:16,789 --> 00:23:14,400
planet now you'll notice as these

636
00:23:18,789 --> 00:23:16,799
magnetic field lines of the sun come in

637
00:23:20,870 --> 00:23:18,799
you'll be able to see them connect and

638
00:23:23,270 --> 00:23:20,880

disconnect with the earth's magnetic

639
00:23:25,350 --> 00:23:23,280
field and it doesn't stop there

640
00:23:28,310 --> 00:23:25,360
those field lines the sun's field lines

641
00:23:30,230 --> 00:23:28,320
actually pull the earth's field lines

642
00:23:32,549 --> 00:23:30,240
behind the earth as the earth continues

643
00:23:34,950 --> 00:23:32,559
to regenerate field lines in front and

644
00:23:36,789 --> 00:23:34,960
in the back in the magnetotail there was

645
00:23:39,029 --> 00:23:36,799
another reconnection event that just

646
00:23:41,269 --> 00:23:39,039
happened which forced energy out of the

647
00:23:43,350 --> 00:23:41,279
tail of the sun or the earth and also

648
00:23:44,710 --> 00:23:43,360
into the north and south pole and paul

649
00:23:46,870 --> 00:23:44,720
what happens when you put a lot of

650
00:23:48,870 --> 00:23:46,880
energy into the north and south pole the

651
00:23:50,710 --> 00:23:48,880
atmosphere glows as an aurora it flows

652
00:23:52,070 --> 00:23:50,720
as an aurora which is really really

653
00:23:53,669 --> 00:23:52,080
amazing

654
00:23:55,750 --> 00:23:53,679
this is uh quite beautiful i think

655
00:23:59,110 --> 00:23:55,760
they're going to run some image from the

656
00:24:03,029 --> 00:24:01,029
there we go there we go i had the

657
00:24:04,470 --> 00:24:03,039
opportunity of with our team to go to

658
00:24:06,630 --> 00:24:04,480
barrow alaska

659
00:24:08,070 --> 00:24:06,640
and watch first light when the sun first

660
00:24:10,310 --> 00:24:08,080
appeared just for a moment over the

661
00:24:12,950 --> 00:24:10,320
horizon and each night we would run out

662
00:24:14,549 --> 00:24:12,960
and see these beautiful green aurora

663
00:24:16,149 --> 00:24:14,559

okay hey the sun just peeked out of a

664
00:24:18,630 --> 00:24:16,159
hole in the clouds awesome let's go

665
00:24:20,630 --> 00:24:18,640
ahead and take a look at that partial

666
00:24:22,870 --> 00:24:20,640
eclipse boy it is really getting to be a

667
00:24:24,470 --> 00:24:22,880
narrow arc of the sun right now

668
00:24:26,390 --> 00:24:24,480
and we can see

669
00:24:27,990 --> 00:24:26,400
those uh filaments on the surface of the

670
00:24:29,430 --> 00:24:28,000
sun and hydrogen alpha

671
00:24:30,390 --> 00:24:29,440
and the

672
00:24:31,750 --> 00:24:30,400
sun

673
00:24:33,590 --> 00:24:31,760
coming up

674
00:24:35,269 --> 00:24:33,600
with my solar glasses i was able to it

675
00:24:38,070 --> 00:24:35,279
looks just like a little sliver right

676
00:24:39,750 --> 00:24:38,080
now to the human eye excellent most

677
00:24:41,590 --> 00:24:39,760
excellent yeah exciting i can also

678
00:24:43,350 --> 00:24:41,600
notice the lighting is starting to go

679
00:24:44,070 --> 00:24:43,360
down dramatically here around us that's

680
00:24:47,110 --> 00:24:44,080
right

681
00:24:49,590 --> 00:24:47,120
definitely the the sun is mostly blocked

682
00:24:52,710 --> 00:24:49,600
it's getting cool it is it is cooler

683
00:24:55,990 --> 00:24:52,720
here that's really amazing

684
00:24:59,269 --> 00:24:56,000
yay well that's i understand that the

685
00:25:00,870 --> 00:24:59,279
magnetic the mms mission has some a real

686
00:25:02,870 --> 00:25:00,880
goal to help us

687
00:25:04,789 --> 00:25:02,880
live on earth it really does we're

688
00:25:06,630 --> 00:25:04,799

really concerned about societal impacts

689
00:25:09,190 --> 00:25:06,640
and how we live here on earth and how

690
00:25:10,710 --> 00:25:09,200
these how the magnetic energy that we

691
00:25:12,630 --> 00:25:10,720
have and all of these solar storms

692
00:25:14,789 --> 00:25:12,640
impact us in space and on the ground

693
00:25:17,110 --> 00:25:14,799
with potential blackouts and even damage

694
00:25:18,390 --> 00:25:17,120
to satellites so nasa is very invested

695
00:25:20,789 --> 00:25:18,400
with people and partners around the

696
00:25:22,870 --> 00:25:20,799
world to be able to launch satellites

697
00:25:24,710 --> 00:25:22,880
into space that study solar weather and

698
00:25:26,070 --> 00:25:24,720
space weather i have a video with me of

699
00:25:28,390 --> 00:25:26,080
an amazing mission called the

700
00:25:30,230 --> 00:25:28,400
magnetospheric multiscale mission that

701
00:25:32,310 --> 00:25:30,240
actually it's almost the anniversary of

702
00:25:33,190 --> 00:25:32,320
their launch and they launched on march

703
00:25:35,750 --> 00:25:33,200
12th

704
00:25:37,590 --> 00:25:35,760
last year uh here in this animation that

705
00:25:38,470 --> 00:25:37,600
we're we're looking at paul we can start

706
00:25:39,909 --> 00:25:38,480
that

707
00:25:43,029 --> 00:25:39,919
you'll be able to see something called

708
00:25:45,350 --> 00:25:43,039
an atlas v rocket now what was really

709
00:25:47,190 --> 00:25:45,360
cool about being at this launch is we

710
00:25:48,710 --> 00:25:47,200
invited students from texas and from

711
00:25:51,029 --> 00:25:48,720
west virginia and all over the united

712
00:25:52,710 --> 00:25:51,039
states to be part of this launch these

713
00:25:54,310 --> 00:25:52,720

students in west virginia actually built

714
00:25:56,710 --> 00:25:54,320
a life-size model of their own that we

715
00:25:58,230 --> 00:25:56,720
have on display in this animation now

716
00:26:00,950 --> 00:25:58,240
you'll notice florida way in the

717
00:26:04,310 --> 00:26:00,960
distance on earth and in just a moment

718
00:26:06,789 --> 00:26:04,320
the nosecone has all four satellites

719
00:26:09,110 --> 00:26:06,799
they're 11 feet wide four feet high

720
00:26:12,149 --> 00:26:09,120
26 instruments aboard each satellite

721
00:26:13,590 --> 00:26:12,159
with booms that go out and antennas

722
00:26:16,630 --> 00:26:13,600
and some of these antennas actually

723
00:26:18,230 --> 00:26:16,640
stretch out to 160 feet apiece and

724
00:26:19,750 --> 00:26:18,240
you'll notice there's a minor charge

725
00:26:21,909 --> 00:26:19,760
between the satellites as they reach

726
00:26:24,470 --> 00:26:21,919
orbit or towards orbit and then they're

727
00:26:25,909 --> 00:26:24,480
able to separate and start

728
00:26:28,230 --> 00:26:25,919
forming something that is like a

729
00:26:30,390 --> 00:26:28,240
tetrahedral formation

730
00:26:32,230 --> 00:26:30,400
and i actually brought something paul

731
00:26:34,149 --> 00:26:32,240
that i'll be able to show you that

732
00:26:36,230 --> 00:26:34,159
students can actually do and download in

733
00:26:37,750 --> 00:26:36,240
their classroom in just a moment now

734
00:26:39,110 --> 00:26:37,760
take a look at how beautiful these

735
00:26:41,029 --> 00:26:39,120
satellites are

736
00:26:42,470 --> 00:26:41,039
uh these satellites will actually move

737
00:26:44,630 --> 00:26:42,480
around and they're searching for

738
00:26:46,390 --> 00:26:44,640

magnetic reconnection regions that are

739
00:26:48,870 --> 00:26:46,400
around the earth because we can reach

740
00:26:51,510 --> 00:26:48,880
the earth's uh magnetosphere and we

741
00:26:53,590 --> 00:26:51,520
treat it like a laboratory now as they

742
00:26:55,110 --> 00:26:53,600
go around and find a magnetic

743
00:26:57,990 --> 00:26:55,120
reconnection event

744
00:27:00,310 --> 00:26:58,000
they will fly around in formation and

745
00:27:02,710 --> 00:27:00,320
they have over 26 or 26 instruments

746
00:27:05,110 --> 00:27:02,720
aboard each one that will all snap at

747
00:27:07,430 --> 00:27:05,120
the same time there are no cameras but

748
00:27:11,830 --> 00:27:07,440
we get three dimensional data that's why

749
00:27:15,510 --> 00:27:13,510
yeah that's really quite a formation

750
00:27:17,430 --> 00:27:15,520
with those giant antennas and i'm glad

751
00:27:18,549 --> 00:27:17,440
you brought your uh visualization with

752
00:27:20,230 --> 00:27:18,559
us

753
00:27:22,389 --> 00:27:20,240
this is one of them on those that

754
00:27:24,230 --> 00:27:22,399
magnetic field reconnection events

755
00:27:26,870 --> 00:27:24,240
around the earth i understand that it

756
00:27:30,070 --> 00:27:26,880
can really impact power lines it sure

757
00:27:31,909 --> 00:27:30,080
can it sure can and somewhat 1989 for

758
00:27:33,830 --> 00:27:31,919
instance there was a large power outage

759
00:27:36,310 --> 00:27:33,840
in canada and north and northeastern

760
00:27:37,750 --> 00:27:36,320
united states lasted several days and it

761
00:27:39,830 --> 00:27:37,760
was pretty intense

762
00:27:42,070 --> 00:27:39,840
now if you'd like to take a look at my

763
00:27:44,070 --> 00:27:42,080

visual this is uh the representation if

764
00:27:45,110 --> 00:27:44,080
this is a magnetic reconnection event

765
00:27:47,430 --> 00:27:45,120
yes

766
00:27:49,750 --> 00:27:47,440
my hand these satellites are flying

767
00:27:51,590 --> 00:27:49,760
really fast and they boom right as that

768
00:27:53,909 --> 00:27:51,600
reconnection event happens and energy is

769
00:27:55,430 --> 00:27:53,919
released they snap all other instruments

770
00:27:57,430 --> 00:27:55,440
and then the satellites keep on moving

771
00:27:59,430 --> 00:27:57,440
on in formation so it's quite a nice

772
00:28:01,750 --> 00:27:59,440
visualization for the classroom that

773
00:28:03,590 --> 00:28:01,760
sounds that sounds really excellent and

774
00:28:05,510 --> 00:28:03,600
what is this another tool you have here

775
00:28:07,669 --> 00:28:05,520
yeah this is uh basically we're also

776
00:28:10,310 --> 00:28:07,679
experimenting with virtual reality so we

777
00:28:12,310 --> 00:28:10,320
will have files online very soon for you

778
00:28:13,909 --> 00:28:12,320
to go and look at the satellite in space

779
00:28:15,350 --> 00:28:13,919
with you can use google glass you can

780
00:28:17,590 --> 00:28:15,360
use oculus there's several different

781
00:28:19,350 --> 00:28:17,600
ways to be able to do this and it's just

782
00:28:21,430 --> 00:28:19,360
amazing it gives you a sense of presence

783
00:28:23,269 --> 00:28:21,440
of actually being in space or even on

784
00:28:24,950 --> 00:28:23,279
mars or other planets if you choose

785
00:28:26,870 --> 00:28:24,960
that's really fantastic i'm looking

786
00:28:29,350 --> 00:28:26,880
forward to that we still have

787
00:28:30,870 --> 00:28:29,360
clouds overhead but i'm looking to where

788
00:28:33,029 --> 00:28:30,880

the clouds are coming from and there's a

789
00:28:35,350 --> 00:28:33,039
big blue patch coming on here i'm

790
00:28:37,830 --> 00:28:35,360
excited to be a great hope for uh clear

791
00:28:39,269 --> 00:28:37,840
skies and totality in fact uh here's the

792
00:28:41,669 --> 00:28:39,279
sun coming through a quick hole right

793
00:28:43,190 --> 00:28:41,679
now oh that's beautiful we can go to

794
00:28:45,750 --> 00:28:43,200
telescopes here

795
00:28:48,470 --> 00:28:45,760
and uh that that wonderful arch of the

796
00:28:50,710 --> 00:28:48,480
sun and that prominence oh look at this

797
00:28:52,389 --> 00:28:50,720
isn't it beautiful yeah it's like the

798
00:28:54,710 --> 00:28:52,399
sun decided to show off for us a little

799
00:28:56,070 --> 00:28:54,720
bit today didn't it it's great to be

800
00:28:59,110 --> 00:28:56,080
able to have it pop through those holes

801
00:29:00,310 --> 00:28:59,120
in the clouds so we can see it there's a

802
00:29:02,149 --> 00:29:00,320
cloud

803
00:29:04,470 --> 00:29:02,159
when i look on the horizon we have clear

804
00:29:06,470 --> 00:29:04,480
skies coming in just about 30 minutes or

805
00:29:08,149 --> 00:29:06,480
30 seconds i think i think we got some

806
00:29:09,830 --> 00:29:08,159
really good clear skies coming we have

807
00:29:10,870 --> 00:29:09,840
some great viewing opportunity well

808
00:29:13,669 --> 00:29:10,880
let's

809
00:29:22,149 --> 00:29:13,679
minute there's a quick

810
00:29:26,070 --> 00:29:24,389
oh thank you thank you cli troy klein

811
00:29:27,350 --> 00:29:26,080
you are so welcome with all my toys and

812
00:29:28,870 --> 00:29:27,360
gadgets

813
00:29:30,470 --> 00:29:28,880

thanks so much for sharing all that with

814
00:29:31,990 --> 00:29:30,480
us and hi to all of our students around

815
00:29:34,230 --> 00:29:32,000
the world with the mms mission it's

816
00:29:36,070 --> 00:29:34,240
exciting yep i think now we're just want

817
00:29:37,750 --> 00:29:36,080
to get ready for totality it's getting

818
00:29:39,909 --> 00:29:37,760
close people are excited do you see how

819
00:29:42,470 --> 00:29:39,919
dark it is yeah it's really dark it's

820
00:29:45,110 --> 00:29:42,480
really dark and it's so cool we've been

821
00:29:47,590 --> 00:29:45,120
sweating for days in the heat here but

822
00:29:49,750 --> 00:29:47,600
it's noticeably cooler there's a nice

823
00:29:51,110 --> 00:29:49,760
breeze i think the drop in temperature

824
00:29:53,510 --> 00:29:51,120
is having something to do with the

825
00:29:55,190 --> 00:29:53,520
dissipation of the clouds over our head

826
00:29:57,909 --> 00:29:55,200
i think you mentioned it but just in

827
00:30:00,470 --> 00:29:57,919
case you didn't we're seeing a big huge

828
00:30:02,470 --> 00:30:00,480
blue patch behind the sun

829
00:30:03,830 --> 00:30:02,480
i'm not worried about totality i'm sure

830
00:30:05,750 --> 00:30:03,840
we're gonna we're gonna be able to have

831
00:30:07,510 --> 00:30:05,760
a great experience of it why don't we

832
00:30:09,110 --> 00:30:07,520
just keep looking at the telescopes

833
00:30:11,190 --> 00:30:09,120
though for a little while now that it's

834
00:30:13,830 --> 00:30:11,200
clear now that it's clear let's let

835
00:30:16,789 --> 00:30:13,840
everybody get a good good view of this

836
00:30:19,830 --> 00:30:16,799
small crescent with that huge huge

837
00:30:21,110 --> 00:30:19,840
prominence it's absolutely

838
00:30:24,149 --> 00:30:21,120

gorgeous

839
00:30:26,389 --> 00:30:24,159
i would say here on wooly eye as it dims

840
00:30:29,350 --> 00:30:26,399
we've got probably

841
00:30:32,789 --> 00:30:29,360
i don't know 200 250 people standing

842
00:30:34,630 --> 00:30:32,799
around us it's mostly the woolly irons

843
00:30:36,870 --> 00:30:34,640
a lot of the people from the high school

844
00:30:39,350 --> 00:30:36,880
are here we've seen a lot of students we

845
00:30:41,190 --> 00:30:39,360
have the crew of the solitude one here

846
00:30:43,750 --> 00:30:41,200
um we're getting a lot of cheers from

847
00:30:47,269 --> 00:30:45,830
the the the kids are watching a video

848
00:30:49,029 --> 00:30:47,279
monitor seeing what you're seeing out

849
00:30:51,510 --> 00:30:49,039
there in the world and we just hear

850
00:30:53,350 --> 00:30:51,520
these yells and and cheering going on

851
00:30:54,870 --> 00:30:53,360
whenever something really cool shows up

852
00:30:57,430 --> 00:30:54,880
yeah and also every time the clouds show

853
00:30:59,029 --> 00:30:57,440
up there's sort of a

854
00:31:02,149 --> 00:30:59,039
quiet and then as soon as the sun

855
00:31:05,190 --> 00:31:02,159
reappears we get a big big cheer so what

856
00:31:08,149 --> 00:31:05,200
i'm seeing now over our head is just a

857
00:31:09,430 --> 00:31:08,159
few wispy clouds remaining in the sky i

858
00:31:10,710 --> 00:31:09,440
think we're going to be good there's a

859
00:31:13,269 --> 00:31:10,720
small patch

860
00:31:14,710 --> 00:31:13,279
maybe 10 minutes but it's very wispy and

861
00:31:17,110 --> 00:31:14,720
i think the temperature change again

862
00:31:19,269 --> 00:31:17,120
might dissipate that so we're looking

863
00:31:22,070 --> 00:31:19,279

really really good

864
00:31:24,389 --> 00:31:22,080
we're now about

865
00:31:26,389 --> 00:31:24,399
10 minutes is that right from totality

866
00:31:27,509 --> 00:31:26,399
yeah it's about 10 minutes from totality

867
00:31:29,509 --> 00:31:27,519
okay

868
00:31:31,029 --> 00:31:29,519
so looking good so why don't we talk a

869
00:31:33,990 --> 00:31:31,039
little bit since we have some time right

870
00:31:35,990 --> 00:31:34,000
now about what it is um that's going to

871
00:31:37,990 --> 00:31:36,000
happen in tutorials we keep mentioning

872
00:31:39,750 --> 00:31:38,000
but we haven't actually talked about it

873
00:31:40,789 --> 00:31:39,760
directly

874
00:31:43,190 --> 00:31:40,799
yeah so

875
00:31:44,789 --> 00:31:43,200
as this crescent gets smaller and

876
00:31:46,710 --> 00:31:44,799
smaller thinner and thinner it'll get

877
00:31:48,710 --> 00:31:46,720
shorter and shorter until

878
00:31:51,029 --> 00:31:48,720
just one little bit of the photosphere

879
00:31:52,549 --> 00:31:51,039
is left uncovered by the moon and that

880
00:31:54,789 --> 00:31:52,559
will lead to a phenomena called the

881
00:31:56,950 --> 00:31:54,799
diamond ring with a bright spot like the

882
00:31:58,630 --> 00:31:56,960
diamond and a gentle ring of light

883
00:32:00,310 --> 00:31:58,640
around the moon

884
00:32:02,149 --> 00:32:00,320
that's right and so we have an image of

885
00:32:03,830 --> 00:32:02,159
that now this isn't right now

886
00:32:05,669 --> 00:32:03,840
this image was taken a couple years ago

887
00:32:07,190 --> 00:32:05,679
but it does show the diamond ring it's

888
00:32:09,669 --> 00:32:07,200

going to happen quickly it's only going

889
00:32:11,509 --> 00:32:09,679
to last for what do you think 15 seconds

890
00:32:13,750 --> 00:32:11,519
or much much shorter just a few seconds

891
00:32:14,789 --> 00:32:13,760
and so um we'll have that moment of the

892
00:32:16,389 --> 00:32:14,799
diamond ring and we'll probably get

893
00:32:18,549 --> 00:32:16,399
excited we'll probably be yelling

894
00:32:20,470 --> 00:32:18,559
diamond ring diamond ring diamond ring

895
00:32:22,389 --> 00:32:20,480
and then the next thing we'll see is

896
00:32:24,950 --> 00:32:22,399
called bailey's beads bailey's beads and

897
00:32:28,149 --> 00:32:24,960
so the moon is not a smooth sphere it

898
00:32:30,950 --> 00:32:28,159
has canyons and mountains on the edge of

899
00:32:33,350 --> 00:32:30,960
the moon and the photosphere can light

900
00:32:35,830 --> 00:32:33,360
can leak through those canyons and give

901
00:32:37,269 --> 00:32:35,840
us things called bailey's beads and so

902
00:32:39,350 --> 00:32:37,279
we'll also call out bailey's beads if

903
00:32:41,110 --> 00:32:39,360
they occur if they occur it's different

904
00:32:43,269 --> 00:32:41,120
the edge of the moon is different at

905
00:32:45,190 --> 00:32:43,279
every eclipse so it'll be a unique

906
00:32:47,110 --> 00:32:45,200
expression and when the bailey's beads

907
00:32:48,870 --> 00:32:47,120
comes out and you're looking through

908
00:32:50,149 --> 00:32:48,880
your glasses when the bailey's beads

909
00:32:51,669 --> 00:32:50,159
disappear

910
00:32:53,909 --> 00:32:51,679
you see nothing through your safe

911
00:32:57,190 --> 00:32:53,919
viewing glasses that's when you take off

912
00:32:58,710 --> 00:32:57,200
your glasses and look at totality that's

913
00:33:00,549 --> 00:32:58,720

right i think that's uh

914
00:33:02,630 --> 00:33:00,559
something again people don't realize is

915
00:33:05,029 --> 00:33:02,640
actually when the disk of the sun is

916
00:33:06,950 --> 00:33:05,039
completely covered by the moon

917
00:33:08,789 --> 00:33:06,960
you can actually look at the sun with

918
00:33:10,389 --> 00:33:08,799
your naked eyeballs but i want to

919
00:33:12,070 --> 00:33:10,399
backtrack just a minute about bailey's

920
00:33:13,909 --> 00:33:12,080
speeds and if we see them we'll yell it

921
00:33:15,350 --> 00:33:13,919
out but i just want to what you're

922
00:33:17,990 --> 00:33:15,360
telling me

923
00:33:21,350 --> 00:33:18,000
is that there's little valleys and

924
00:33:22,789 --> 00:33:21,360
little divots on the edge of the moon

925
00:33:24,630 --> 00:33:22,799
and that the light will leak through

926
00:33:26,310 --> 00:33:24,640
them and we can see that that's right

927
00:33:28,389 --> 00:33:26,320
the light just shines through that gash

928
00:33:30,389 --> 00:33:28,399
in the edge of the moon and you see the

929
00:33:35,350 --> 00:33:30,399
photosphere it makes these beautiful

930
00:33:38,389 --> 00:33:36,549
and then

931
00:33:40,149 --> 00:33:38,399
when we get to totality this is just an

932
00:33:41,909 --> 00:33:40,159
image this is not live right now again

933
00:33:43,509 --> 00:33:41,919
this was recorded a couple years ago

934
00:33:45,509 --> 00:33:43,519
we'll get to see the corona of the sun

935
00:33:48,070 --> 00:33:45,519
this is this white light reaching out

936
00:33:49,750 --> 00:33:48,080
from a black disk

937
00:33:53,750 --> 00:33:49,760
which is the moon blocking the

938
00:33:55,190 --> 00:33:53,760

photosphere of the sun and the corona

939
00:33:57,269 --> 00:33:55,200
was discovered

940
00:34:00,070 --> 00:33:57,279
during a total solar eclipse the first

941
00:34:01,909 --> 00:34:00,080
drawings of the corona and in the corona

942
00:34:03,830 --> 00:34:01,919
as you're as you see it there will be

943
00:34:05,669 --> 00:34:03,840
lines perhaps the lines of the solar

944
00:34:07,509 --> 00:34:05,679
magnetic field reminding us the sun is a

945
00:34:08,790 --> 00:34:07,519
magnetic body that's right and it's not

946
00:34:10,869 --> 00:34:08,800
even going to look like this hopefully

947
00:34:12,470 --> 00:34:10,879
it'll look really different

948
00:34:14,550 --> 00:34:12,480
that's right well we'll see that that's

949
00:34:17,589 --> 00:34:14,560
one of the great joys of every solar

950
00:34:19,109 --> 00:34:17,599
eclipse looks different

951
00:34:20,629 --> 00:34:19,119
that's why we have to go to them and i

952
00:34:23,589 --> 00:34:20,639
just want to point out you're really

953
00:34:25,270 --> 00:34:23,599
fading for my view it's it's it's really

954
00:34:27,190 --> 00:34:25,280
beginning to get dark and the shadows

955
00:34:29,030 --> 00:34:27,200
are quite strange on the ground right

956
00:34:31,190 --> 00:34:29,040
i'm actually not seeing many shadows

957
00:34:33,589 --> 00:34:31,200
they've kind of disappeared

958
00:34:35,750 --> 00:34:33,599
things feel a little bit a little weird

959
00:34:38,230 --> 00:34:35,760
it's like twilight

960
00:34:39,829 --> 00:34:38,240
but not really yeah definitely twilight

961
00:34:42,069 --> 00:34:39,839
and and sometimes

962
00:34:44,869 --> 00:34:42,079
the evening animals the birds start to

963
00:34:47,430 --> 00:34:44,879

sing in the in the forest uh during uh

964
00:34:49,270 --> 00:34:47,440
this this darkening time so we'll listen

965
00:34:51,430 --> 00:34:49,280
in to hear what we hear mostly i hear

966
00:34:53,829 --> 00:34:51,440
people being very excited

967
00:34:56,149 --> 00:34:53,839
by the the sun being such a thin arc of

968
00:34:57,510 --> 00:34:56,159
light yeah it's true we did ask the high

969
00:34:59,349 --> 00:34:57,520
school students when we're out at the

970
00:35:01,270 --> 00:34:59,359
schools that there was a lot of night

971
00:35:02,390 --> 00:35:01,280
song from the local birds and they said

972
00:35:03,990 --> 00:35:02,400
that there was so it's something we

973
00:35:05,750 --> 00:35:04,000
should we should listen for i'm not sure

974
00:35:07,270 --> 00:35:05,760
we can hear it here on the runway but we

975
00:35:08,870 --> 00:35:07,280
do expect animals to go into their

976
00:35:10,310 --> 00:35:08,880
nighttime behaviors

977
00:35:13,349 --> 00:35:10,320
they definitely interpret this as

978
00:35:15,270 --> 00:35:13,359
twilight they do

979
00:35:16,550 --> 00:35:15,280
we're experiencing that last little wisp

980
00:35:19,190 --> 00:35:16,560
of clouds i'm not sure they're going to

981
00:35:21,349 --> 00:35:19,200
show up on the telescopes at all but

982
00:35:22,790 --> 00:35:21,359
after these few little whiskies there's

983
00:35:25,109 --> 00:35:22,800
absolutely

984
00:35:27,990 --> 00:35:25,119
clear skies so we're going to experience

985
00:35:30,150 --> 00:35:28,000
a fantastic totality

986
00:35:32,710 --> 00:35:30,160
again we're seeing that that crescent

987
00:35:34,950 --> 00:35:32,720
get thinner and thinner

988
00:35:36,230 --> 00:35:34,960

we still have believe it or not a full

989
00:35:38,870 --> 00:35:36,240
five minutes

990
00:35:40,550 --> 00:35:38,880
to go so there's still some time

991
00:35:42,790 --> 00:35:40,560
oh look at that image it's just

992
00:35:45,670 --> 00:35:42,800
absolutely beautiful oh that's a nice

993
00:35:47,270 --> 00:35:45,680
one i really like the sun and now if if

994
00:35:49,030 --> 00:35:47,280
people are are looking they can see it

995
00:35:51,270 --> 00:35:49,040
directly with the safe viewing glasses

996
00:35:53,349 --> 00:35:51,280
you can use safe projection techniques

997
00:35:54,950 --> 00:35:53,359
to project that crescent on the ground

998
00:35:56,150 --> 00:35:54,960
if you're under trees and you look at

999
00:35:59,430 --> 00:35:56,160
the ground

1000
00:36:00,710 --> 00:35:59,440
oh listen to the yell

1001
00:36:02,310 --> 00:36:00,720
we're getting a lot of this i think that

1002
00:36:06,310 --> 00:36:02,320
the local people are anticipating that

1003
00:36:08,550 --> 00:36:06,320
we're closer to totality than we are um

1004
00:36:10,710 --> 00:36:08,560
it is it's so noticeably dark the

1005
00:36:12,950 --> 00:36:10,720
temperature has gotten so much cooler

1006
00:36:14,950 --> 00:36:12,960
we're getting a strong breeze

1007
00:36:16,870 --> 00:36:14,960
and so i think that uh

1008
00:36:20,150 --> 00:36:16,880
this is all in an anticipation of

1009
00:36:23,430 --> 00:36:20,160
totality um this is definitely

1010
00:36:24,950 --> 00:36:23,440
definitely an exciting thing yes

1011
00:36:27,589 --> 00:36:24,960
i'm getting chills and it's not just

1012
00:36:30,870 --> 00:36:27,599
because it's getting cold it is and the

1013
00:36:33,430 --> 00:36:30,880

uh the local community here

1014
00:36:36,230 --> 00:36:33,440
is certainly giving it three cheers

1015
00:36:38,470 --> 00:36:36,240
excitement is mounting

1016
00:36:41,430 --> 00:36:38,480
we are getting very very close people

1017
00:36:43,430 --> 00:36:41,440
are shouting it's dark in the crowd

1018
00:36:44,710 --> 00:36:43,440
there's a lot of yelling

1019
00:36:45,990 --> 00:36:44,720
and

1020
00:36:48,710 --> 00:36:46,000
merriment

1021
00:36:51,030 --> 00:36:48,720
a lot of excitement with my safe viewing

1022
00:36:52,829 --> 00:36:51,040
glasses when i look up i am just seeing

1023
00:36:56,390 --> 00:36:52,839
the smallest

1024
00:36:57,589 --> 00:36:56,400
tiniest of orange crescents

1025
00:36:59,270 --> 00:36:57,599
so we're going to sit

1026
00:37:01,589 --> 00:36:59,280
for a few more minutes

1027
00:37:05,030 --> 00:37:01,599
continue to watch

1028
00:37:06,069 --> 00:37:05,040
if they're this excited

1029
00:37:07,750 --> 00:37:06,079
by

1030
00:37:10,230 --> 00:37:07,760
i know i can't wait for the sun wait

1031
00:37:12,870 --> 00:37:10,240
till they see totality i'm having a hard

1032
00:37:15,030 --> 00:37:12,880
time being patient

1033
00:37:17,430 --> 00:37:15,040
i want to speed up the sun

1034
00:37:19,510 --> 00:37:17,440
the shadow is moving across as paul at a

1035
00:37:21,829 --> 00:37:19,520
thousand miles an hour

1036
00:37:24,310 --> 00:37:21,839
we're getting very near the darkest part

1037
00:37:26,230 --> 00:37:24,320
of the shadow

1038
00:37:29,589 --> 00:37:26,240

i see that the crescent is starting to

1039
00:37:35,270 --> 00:37:29,599
shorten we're getting very close

1040
00:37:39,750 --> 00:37:36,790
i'm sure people at home can hear the

1041
00:37:44,470 --> 00:37:39,760
crowds and excitement here

1042
00:38:12,390 --> 00:37:47,270
oh a tiny little sliver oh it's really

1043
00:38:16,150 --> 00:38:13,910
oh wow

1044
00:38:19,349 --> 00:38:16,160
it's absolutely gorgeous i'm seeing

1045
00:38:22,230 --> 00:38:19,359
stars i believe i see regulus

1046
00:38:23,589 --> 00:38:22,240
oh yeah so that that's venus and mercury

1047
00:38:25,109 --> 00:38:23,599
venus and mercury

1048
00:38:27,750 --> 00:38:25,119
we're not seeing other stars right now

1049
00:38:30,470 --> 00:38:27,760
but we are seeing venus and mercury yeah

1050
00:38:32,550 --> 00:38:30,480
the sky has gone dark it's like night

1051
00:38:34,550 --> 00:38:32,560
coming on and the clouds around the

1052
00:38:38,150 --> 00:38:34,560
horizon are

1053
00:38:39,750 --> 00:38:38,160
dimly lit with yellowish brown it's uh

1054
00:38:42,710 --> 00:38:39,760
the sunlight's still hitting the distant

1055
00:38:44,950 --> 00:38:42,720
clouds it's dark here i see birds flying

1056
00:38:46,470 --> 00:38:44,960
overhead actually a lot of birds can

1057
00:38:53,750 --> 00:38:46,480
come out of the trees and they're

1058
00:38:58,069 --> 00:38:55,990
oh and that prominence sticking up into

1059
00:38:59,990 --> 00:38:58,079
the corona that's unbelievable just

1060
00:39:01,829 --> 00:39:00,000
gorge what a great set of cameras

1061
00:39:05,190 --> 00:39:01,839
absolutely gorgeous if i put on my

1062
00:39:11,750 --> 00:39:05,200
eclipse glasses i cannot see a thing

1063
00:39:15,270 --> 00:39:13,430

that's a prominence

1064
00:39:17,829 --> 00:39:15,280
so people in the crowd are asking us

1065
00:39:19,750 --> 00:39:17,839
what the red prominence is

1066
00:39:21,829 --> 00:39:19,760
they have good eyes

1067
00:39:24,069 --> 00:39:21,839
they have very good eyes

1068
00:39:26,310 --> 00:39:24,079
again it's cool it's the coolest it's

1069
00:39:28,310 --> 00:39:26,320
been since we've been here

1070
00:39:29,990 --> 00:39:28,320
oh this is just everyone has stood up

1071
00:39:32,310 --> 00:39:30,000
and gathered around the hundreds of

1072
00:39:34,710 --> 00:39:32,320
people were sitting relaxing in the

1073
00:39:37,510 --> 00:39:34,720
shade they're all now standing up in

1074
00:39:40,950 --> 00:39:37,520
giant clumps

1075
00:39:42,550 --> 00:39:40,960
there's a lot of kids running around

1076
00:39:44,230 --> 00:39:42,560
it was really great to prepare the kids

1077
00:39:46,230 --> 00:39:44,240
yesterday to tell them take off the

1078
00:39:48,950 --> 00:39:46,240
glasses during totality and i think they

1079
00:39:50,790 --> 00:39:48,960
did from that giant cheer that went up

1080
00:39:53,109 --> 00:39:50,800
yeah i know paul when i when i'm

1081
00:39:55,750 --> 00:39:53,119
standing here it's just it's so

1082
00:39:58,150 --> 00:39:55,760
beautiful it's amazing as i'm standing

1083
00:40:00,310 --> 00:39:58,160
here in the shadow of the moon it's so

1084
00:40:02,310 --> 00:40:00,320
nice and i feel so privileged to be able

1085
00:40:04,390 --> 00:40:02,320
to bring this to the hundreds of

1086
00:40:06,710 --> 00:40:04,400
thousands of people who are watching us

1087
00:40:08,309 --> 00:40:06,720
online and at different science museums

1088
00:40:09,990 --> 00:40:08,319

and i just want to do a few shout outs i

1089
00:40:12,069 --> 00:40:10,000
know they're watching this at the

1090
00:40:16,390 --> 00:40:12,079
singapore science center

1091
00:40:18,309 --> 00:40:16,400
at the casa de chihuahua in mexico

1092
00:40:21,109 --> 00:40:18,319
they're tuned in at the new york hall of

1093
00:40:22,309 --> 00:40:21,119
science in new york of course and at the

1094
00:40:23,750 --> 00:40:22,319
griffith

1095
00:40:25,990 --> 00:40:23,760
observatory

1096
00:40:28,470 --> 00:40:26,000
in los angeles and i also want to

1097
00:40:30,710 --> 00:40:28,480
mention a very special viewing party

1098
00:40:33,829 --> 00:40:30,720
near the rose garden in san jose

1099
00:40:39,349 --> 00:40:36,150
so look the crowd is sort of quiet i

1100
00:40:41,190 --> 00:40:39,359
think they might be a little odd

1101
00:40:43,430 --> 00:40:41,200
i know who i am

1102
00:40:45,030 --> 00:40:43,440
it's amazing and my eyes are adapting to

1103
00:40:48,150 --> 00:40:45,040
the dark so i'm seeing more and more

1104
00:40:50,230 --> 00:40:48,160
detail in the corona i can actually see

1105
00:40:52,309 --> 00:40:50,240
the pink prominence yeah and the corona

1106
00:40:53,430 --> 00:40:52,319
is reaching out more than one solar

1107
00:40:54,630 --> 00:40:53,440
diameter

1108
00:40:57,829 --> 00:40:54,640
and in particular i think there's a

1109
00:40:59,829 --> 00:40:57,839
helmet streamer it's like like a

1110
00:41:02,309 --> 00:40:59,839
world war one helmet right so we call

1111
00:41:04,829 --> 00:41:02,319
that they're sort of long and quainted

1112
00:41:07,510 --> 00:41:04,839
that's right it really stands out and

1113
00:41:09,270 --> 00:41:07,520

again venus and mercury are incredibly

1114
00:41:10,870 --> 00:41:09,280
bright in the sky

1115
00:41:12,870 --> 00:41:10,880
they they are showing up i'm looking

1116
00:41:15,030 --> 00:41:12,880
around i don't see any other bright

1117
00:41:17,670 --> 00:41:15,040
stars at the moment but of course the

1118
00:41:20,150 --> 00:41:17,680
stars that are in the sky now would be

1119
00:41:21,589 --> 00:41:20,160
the stars that were in the night sky six

1120
00:41:22,870 --> 00:41:21,599
months ago

1121
00:41:25,430 --> 00:41:22,880
because we're looking at the daylight

1122
00:41:26,710 --> 00:41:25,440
sky not the nighttime sky

1123
00:41:29,270 --> 00:41:26,720
okay so everyone's cheering we're

1124
00:41:32,950 --> 00:41:29,280
getting a lot of detail

1125
00:41:37,190 --> 00:41:35,030
it's absolutely gorgeous you know paul i

1126
00:41:39,589 --> 00:41:37,200
also want to thank um

1127
00:41:42,150 --> 00:41:39,599
nasa and the national science foundation

1128
00:41:44,390 --> 00:41:42,160
for really making this possible

1129
00:41:47,030 --> 00:41:44,400
i'm a got to remind people the national

1130
00:41:50,069 --> 00:41:47,040
science foundation also supports

1131
00:41:51,829 --> 00:41:50,079
astronomy and astronomical sciences

1132
00:41:54,790 --> 00:41:51,839
and education

1133
00:41:57,589 --> 00:41:54,800
that's right they have some ground-based

1134
00:41:59,990 --> 00:41:57,599
uh observatories including the

1135
00:42:02,950 --> 00:42:00,000
national solar observer oh here comes

1136
00:42:04,390 --> 00:42:02,960
here comes the diamond ring okay

1137
00:42:06,870 --> 00:42:04,400
people need to put their glasses time to

1138
00:42:08,069 --> 00:42:06,880

put your glasses on

1139
00:42:13,430 --> 00:42:08,079
glasses

1140
00:42:15,109 --> 00:42:13,440
goodness that's so fast all of a sudden

1141
00:42:16,470 --> 00:42:15,119
everything's lightening up just with

1142
00:42:18,870 --> 00:42:16,480
that tiny

1143
00:42:23,750 --> 00:42:18,880
tiny bit of sun

1144
00:42:28,230 --> 00:42:25,829
and here comes the arc

1145
00:42:30,550 --> 00:42:28,240
of sun expanding

1146
00:42:33,270 --> 00:42:30,560
oh i'm so happy that the clouds

1147
00:42:36,309 --> 00:42:33,280
completely cleared as they often do

1148
00:42:38,950 --> 00:42:36,319
so long totality that was awesome

1149
00:42:42,069 --> 00:42:38,960
absolutely incredible

1150
00:42:46,390 --> 00:42:44,950
that was truly amazing yeah i was on the

1151
00:42:49,589 --> 00:42:46,400
edge of my seat when those big clouds

1152
00:42:53,349 --> 00:42:52,230
okay so as the light returns

1153
00:42:54,309 --> 00:42:53,359
oh

1154
00:42:56,550 --> 00:42:54,319
yeah

1155
00:42:59,030 --> 00:42:56,560
i think what i'm gonna do is i'm gonna

1156
00:43:00,790 --> 00:42:59,040
go over and i'm going to see if there's

1157
00:43:03,109 --> 00:43:00,800
other people around

1158
00:43:04,150 --> 00:43:03,119
see what they thought of the eclipse

1159
00:43:05,670 --> 00:43:04,160
yeah

1160
00:43:08,150 --> 00:43:05,680
so troy

1161
00:43:10,710 --> 00:43:08,160
hey robin this i am so excited my heart

1162
00:43:12,870 --> 00:43:10,720
is pounding right now that was amazing i

1163
00:43:14,630 --> 00:43:12,880

couldn't believe how long totality was

1164
00:43:17,030 --> 00:43:14,640
and just before we had all of those

1165
00:43:19,270 --> 00:43:17,040
clouds and it just completely cleared up

1166
00:43:21,030 --> 00:43:19,280
and just made a beautiful sky and then

1167
00:43:23,190 --> 00:43:21,040
when i saw exploratorium launched the

1168
00:43:25,430 --> 00:43:23,200
drone into the sky to capture it it made

1169
00:43:27,109 --> 00:43:25,440
it even more exciting for everybody here

1170
00:43:28,790 --> 00:43:27,119
yep yeah we'll hopefully have really

1171
00:43:30,710 --> 00:43:28,800
good images from that drone i think we

1172
00:43:33,829 --> 00:43:30,720
will post online later our hope is to

1173
00:43:35,829 --> 00:43:33,839
get a whole 360 of the view here oh that

1174
00:43:38,550 --> 00:43:35,839
would just be incredible we'll see if my

1175
00:43:40,870 --> 00:43:38,560
video my camera turned out too okay okay

1176
00:43:43,670 --> 00:43:40,880
we'll check it out thank you and we also

1177
00:43:45,109 --> 00:43:43,680
have some local folks is anybody here

1178
00:43:46,790 --> 00:43:45,119
want to talk what did you think of the

1179
00:43:51,510 --> 00:43:46,800
eclipse

1180
00:43:52,390 --> 00:43:51,520
of course do you think it was beautiful

1181
00:43:56,069 --> 00:43:52,400
yeah

1182
00:44:00,950 --> 00:43:58,309
you say it in the microphone absolutely

1183
00:44:02,550 --> 00:44:00,960
amazing it was it was really beautiful

1184
00:44:04,150 --> 00:44:02,560
beautiful was it what you expected to

1185
00:44:06,550 --> 00:44:04,160
see uh no

1186
00:44:10,630 --> 00:44:06,560
i didn't accept expect to see the stars

1187
00:44:12,630 --> 00:44:10,640
but i did see the stars yeah

1188
00:44:15,589 --> 00:44:12,640

yeah excellent

1189
00:44:19,190 --> 00:44:15,599
can i talk this is the life

1190
00:44:21,510 --> 00:44:19,200
life sure okay i'm gonna say

1191
00:44:25,270 --> 00:44:21,520
i'm gonna miss you my daughter

1192
00:44:27,270 --> 00:44:25,280
and son in hawaii daughter and pon pig i

1193
00:44:29,750 --> 00:44:27,280
love you i miss you

1194
00:44:31,990 --> 00:44:29,760
okay thank you okay great well great

1195
00:44:34,550 --> 00:44:32,000
great relax enjoy

1196
00:44:36,470 --> 00:44:34,560
what's happening today we have over here

1197
00:44:37,829 --> 00:44:36,480
actually coincidentally

1198
00:44:39,829 --> 00:44:37,839
we have the director of the

1199
00:44:40,710 --> 00:44:39,839
exploratorium rob semper is there

1200
00:44:42,950 --> 00:44:40,720
anything you want to say about the

1201
00:44:44,069 --> 00:44:42,960
eclipse hi robin well it was an amazing

1202
00:44:46,309 --> 00:44:44,079
experience

1203
00:44:47,990 --> 00:44:46,319
heart failure with the clouds but they

1204
00:44:49,910 --> 00:44:48,000
parted at the very end which is sort of

1205
00:44:51,190 --> 00:44:49,920
a magic of the eclipse imagine wally

1206
00:44:53,430 --> 00:44:51,200
island

1207
00:44:57,030 --> 00:44:53,440
i've seen a couple eclipses one in china

1208
00:44:59,190 --> 00:44:57,040
in 2008 one in turkey this one was

1209
00:45:01,510 --> 00:44:59,200
completely different it was amazing

1210
00:45:04,069 --> 00:45:01,520
because of the sunrise that you saw 360

1211
00:45:06,230 --> 00:45:04,079
around the sky was not nearly as dark as

1212
00:45:08,870 --> 00:45:06,240
it was in china but it still had that

1213
00:45:11,109 --> 00:45:08,880

magical piece of having uh looked like a

1214
00:45:12,630 --> 00:45:11,119
hole was punched in the sky where the

1215
00:45:14,309 --> 00:45:12,640
moon was covering the sun it was just

1216
00:45:15,990 --> 00:45:14,319
completely black and then you saw the

1217
00:45:18,309 --> 00:45:16,000
corona around it and every time i see

1218
00:45:20,630 --> 00:45:18,319
that it just makes my heart sing to see

1219
00:45:22,230 --> 00:45:20,640
that kind of experience so really wild

1220
00:45:24,150 --> 00:45:22,240
really great to be here and really glad

1221
00:45:26,150 --> 00:45:24,160
to have the view without the clouds

1222
00:45:28,230 --> 00:45:26,160
blocking it for us

1223
00:45:30,230 --> 00:45:28,240
great rob thank you so much we have

1224
00:45:31,829 --> 00:45:30,240
another local person here who's actually

1225
00:45:33,510 --> 00:45:31,839
the principal of the high school

1226
00:45:35,750 --> 00:45:33,520
alantino

1227
00:45:38,550 --> 00:45:35,760
what did you think of the eclipse i i

1228
00:45:40,069 --> 00:45:38,560
think it's amazing i i couldn't believe

1229
00:45:43,030 --> 00:45:40,079
it i couldn't believe that it's going to

1230
00:45:44,470 --> 00:45:43,040
happen today in walia yeah but this

1231
00:45:46,470 --> 00:45:44,480
happening

1232
00:45:48,710 --> 00:45:46,480
amazing amazing and was it what you

1233
00:45:50,390 --> 00:45:48,720
expected to see or was it different well

1234
00:45:51,990 --> 00:45:50,400
i was not really expecting to see

1235
00:45:54,230 --> 00:45:52,000
something that would get darker than

1236
00:45:55,829 --> 00:45:54,240
this yeah uh but

1237
00:45:57,990 --> 00:45:55,839
and if i have my pillow i'll just lay

1238
00:45:59,990 --> 00:45:58,000

down and start sleeping it's already

1239
00:46:01,510 --> 00:46:00,000
nighttime yeah well the sun's slowly

1240
00:46:03,270 --> 00:46:01,520
returning i was wondering alentino is

1241
00:46:05,430 --> 00:46:03,280
there anything you want to talk or to

1242
00:46:07,190 --> 00:46:05,440
say about william and your experience of

1243
00:46:08,710 --> 00:46:07,200
living here well i think walia is a

1244
00:46:10,309 --> 00:46:08,720
really good place

1245
00:46:11,829 --> 00:46:10,319
to stay and you don't have to worry

1246
00:46:14,630 --> 00:46:11,839
about

1247
00:46:16,470 --> 00:46:14,640
money as i would think life here is

1248
00:46:18,950 --> 00:46:16,480
simple everything is simple you just

1249
00:46:20,309 --> 00:46:18,960
leave it each day one at a time yeah

1250
00:46:22,390 --> 00:46:20,319
well we want to thank you so much you've

1251
00:46:24,710 --> 00:46:22,400
been an incredible host and you actually

1252
00:46:26,710 --> 00:46:24,720
yourself it's been alan tino who's been

1253
00:46:28,790 --> 00:46:26,720
driving us back and forth from the beach

1254
00:46:30,390 --> 00:46:28,800
here he's unloaded our gear he's been

1255
00:46:32,069 --> 00:46:30,400
looking out for our gear at night he's

1256
00:46:34,550 --> 00:46:32,079
been covering with training he's really

1257
00:46:37,990 --> 00:46:34,560
done a lot of tremendous work to make

1258
00:46:40,710 --> 00:46:38,000
this program a success thank you so much

1259
00:46:42,870 --> 00:46:40,720
okay so we're walking around there's so

1260
00:46:45,190 --> 00:46:42,880
so many people here i would say in

1261
00:46:46,950 --> 00:46:45,200
general they're a little bit shy on the

1262
00:46:48,630 --> 00:46:46,960
exploratorium the cheers that you hear

1263
00:46:52,309 --> 00:46:48,640

as the exploratorium is again flying our

1264
00:46:54,069 --> 00:46:52,319
drone to try to capture some video image

1265
00:46:56,390 --> 00:46:54,079
so paul

1266
00:46:57,510 --> 00:46:56,400
we also have with us now dr eric

1267
00:47:01,910 --> 00:46:57,520
christian

1268
00:47:03,910 --> 00:47:01,920
he's a nasa mission scientist um so eric

1269
00:47:05,990 --> 00:47:03,920
what did you think of the eclipse wow

1270
00:47:07,670 --> 00:47:06,000
this was really fantastic this is only

1271
00:47:08,470 --> 00:47:07,680
the second total solar eclipse that i've

1272
00:47:09,910 --> 00:47:08,480
seen

1273
00:47:11,750 --> 00:47:09,920
it was very different from the one that

1274
00:47:14,470 --> 00:47:11,760
we saw together in china

1275
00:47:16,790 --> 00:47:14,480
but just absolutely the clouds cleared

1276
00:47:18,470 --> 00:47:16,800
up 10 minutes before the eclipse it was

1277
00:47:20,230 --> 00:47:18,480
wonderful the reaction of people was

1278
00:47:22,309 --> 00:47:20,240
fantastic

1279
00:47:23,750 --> 00:47:22,319
well you know there was a prediction you

1280
00:47:25,829 --> 00:47:23,760
showed me earlier today of what the

1281
00:47:27,750 --> 00:47:25,839
corona would look like how did it appear

1282
00:47:30,309 --> 00:47:27,760
to your eye compared to that prediction

1283
00:47:32,069 --> 00:47:30,319
it's a little hard to tell because the

1284
00:47:33,990 --> 00:47:32,079
the to your eye it was pretty bright

1285
00:47:35,589 --> 00:47:34,000
close in but i think they actually got

1286
00:47:39,910 --> 00:47:35,599
it pretty close yeah they're about four

1287
00:47:44,710 --> 00:47:42,150
from scientists at stanford yeah give

1288
00:47:46,710 --> 00:47:44,720

them credit for it so well

1289
00:47:48,150 --> 00:47:46,720
next year so

1290
00:47:50,950 --> 00:47:48,160
we got a great chance to come here to

1291
00:47:53,190 --> 00:47:50,960
will lay to see this eclipse but next

1292
00:47:55,109 --> 00:47:53,200
year the entire united state states is

1293
00:47:57,109 --> 00:47:55,119
going to get a chance to see if not a

1294
00:47:59,270 --> 00:47:57,119
total solar eclipse a partial solar

1295
00:48:01,510 --> 00:47:59,280
eclipse it's going to be fantastic

1296
00:48:03,589 --> 00:48:01,520
nasa's been planning for over a year and

1297
00:48:05,430 --> 00:48:03,599
a lot of organizations are involved and

1298
00:48:06,790 --> 00:48:05,440
this is going to be wonderful the entire

1299
00:48:09,589 --> 00:48:06,800
united states why don't we roll the

1300
00:48:14,870 --> 00:48:12,630
so this animation shows the both the

1301
00:48:16,710 --> 00:48:14,880
penumbra the shaded area which is the

1302
00:48:19,349 --> 00:48:16,720
partial solar eclipse and the little

1303
00:48:22,470 --> 00:48:19,359
tiny dot is the

1304
00:48:23,510 --> 00:48:22,480
tiny area 100 mile wide that's totality

1305
00:48:25,510 --> 00:48:23,520
and you can see it comes from the

1306
00:48:27,829 --> 00:48:25,520
pacific ocean enters the united states

1307
00:48:29,510 --> 00:48:27,839
at oregon goes right across the heart of

1308
00:48:31,910 --> 00:48:29,520
the united states

1309
00:48:35,190 --> 00:48:31,920
and exits in south carolina

1310
00:48:37,190 --> 00:48:35,200
so the entire country can drive to a

1311
00:48:39,270 --> 00:48:37,200
place that's got a total solar eclipse

1312
00:48:40,390 --> 00:48:39,280
and even if you don't the partial is

1313
00:48:42,230 --> 00:48:40,400

going to be so good that it's going to

1314
00:48:44,069 --> 00:48:42,240
be worth seeing the parcel will be

1315
00:48:47,349 --> 00:48:44,079
visible from all

1316
00:48:49,510 --> 00:48:47,359
places in the lower 48. alaska to hawaii

1317
00:48:51,589 --> 00:48:49,520
actually in florida to maine yep wow

1318
00:48:53,030 --> 00:48:51,599
that's going to be great i hope people

1319
00:48:55,270 --> 00:48:53,040
take advantage of it this is such an

1320
00:48:56,790 --> 00:48:55,280
amazing experience today they you must

1321
00:48:57,990 --> 00:48:56,800
see a total solar eclipse sometimes yeah

1322
00:48:59,430 --> 00:48:58,000
if you get a chance in your life and

1323
00:49:01,270 --> 00:48:59,440
this is one of your best ones you don't

1324
00:49:02,470 --> 00:49:01,280
have to travel far it's going to be

1325
00:49:04,790 --> 00:49:02,480
fantastic

1326
00:49:06,950 --> 00:49:04,800
well let's look at this

1327
00:49:09,910 --> 00:49:06,960
prediction for the eclipse next year in

1328
00:49:11,510 --> 00:49:09,920
more detail okay

1329
00:49:13,190 --> 00:49:11,520
so what are we seeing here

1330
00:49:15,430 --> 00:49:13,200
so here that shows a bunch of different

1331
00:49:17,190 --> 00:49:15,440
rings showing different levels of

1332
00:49:19,990 --> 00:49:17,200
partial eclipse and there you can see

1333
00:49:21,829 --> 00:49:20,000
the red line is the path of totality and

1334
00:49:23,990 --> 00:49:21,839
so the black dots

1335
00:49:25,589 --> 00:49:24,000
the black dot is again

1336
00:49:27,270 --> 00:49:25,599
the total solar eclipse and you can see

1337
00:49:30,790 --> 00:49:27,280
it goes right through salem oregon

1338
00:49:32,549 --> 00:49:30,800

because past a bunch of big cities mrs

1339
00:49:33,430 --> 00:49:32,559
just misses kansas city just misses st

1340
00:49:36,150 --> 00:49:33,440
louis

1341
00:49:38,230 --> 00:49:36,160
you know goes through nashville and then

1342
00:49:40,309 --> 00:49:38,240
off the coast of charleston in south

1343
00:49:42,230 --> 00:49:40,319
carolina so

1344
00:49:43,910 --> 00:49:42,240
just wonderful there's lots of places

1345
00:49:45,349 --> 00:49:43,920
you can travel to and get to see the

1346
00:49:47,990 --> 00:49:45,359
solar eclipse

1347
00:49:48,870 --> 00:49:48,000
that is just amazing

1348
00:49:51,990 --> 00:49:48,880
and

1349
00:49:54,230 --> 00:49:52,000
um so what do it look like so so this is

1350
00:49:56,309 --> 00:49:54,240
a really neat animation that an amateur

1351
00:50:00,069 --> 00:49:56,319
did for us and

1352
00:50:01,990 --> 00:50:00,079
what it shows is one snapshot of time

1353
00:50:03,510 --> 00:50:02,000
when the total solar eclipse is right

1354
00:50:07,349 --> 00:50:03,520
near st louis

1355
00:50:08,870 --> 00:50:07,359
and you can see how partial the sun is

1356
00:50:10,309 --> 00:50:08,880
all the way from the west coast to the

1357
00:50:12,069 --> 00:50:10,319
east coast

1358
00:50:14,870 --> 00:50:12,079
but this is just one snapshot so the

1359
00:50:16,950 --> 00:50:14,880
west coast has already had more

1360
00:50:18,630 --> 00:50:16,960
partial eclipse earlier in the

1361
00:50:21,670 --> 00:50:18,640
in the hour and a half that it'll take

1362
00:50:24,309 --> 00:50:21,680
to go across the united states and the

1363
00:50:26,549 --> 00:50:24,319

east coast will have more coming up so

1364
00:50:27,990 --> 00:50:26,559
but you can see that it's just fantastic

1365
00:50:30,790 --> 00:50:28,000
for the entire

1366
00:50:33,829 --> 00:50:30,800
country gonna be wonderful well i

1367
00:50:35,910 --> 00:50:33,839
understand that next year you have a

1368
00:50:37,349 --> 00:50:35,920
mission that you'll be involved with

1369
00:50:40,309 --> 00:50:37,359
that we should know about so i'm

1370
00:50:43,190 --> 00:50:40,319
currently building an instrument for a

1371
00:50:45,430 --> 00:50:43,200
mission called solar probe plus

1372
00:50:47,349 --> 00:50:45,440
nasa is going to launch solar pro plus

1373
00:50:49,430 --> 00:50:47,359
in 2018

1374
00:50:51,190 --> 00:50:49,440
to study the sun it's going to be our

1375
00:50:53,990 --> 00:50:51,200
first mission to the sun it's going to

1376
00:50:55,589 --> 00:50:54,000
go so close 25 times closer to the earth

1377
00:50:57,829 --> 00:50:55,599
to within four million miles of the

1378
00:51:00,069 --> 00:50:57,839
surface of the sun and the way we do

1379
00:51:02,790 --> 00:51:00,079
that is we hide in the shadows we've got

1380
00:51:05,349 --> 00:51:02,800
this enormous heat shield in front of us

1381
00:51:07,109 --> 00:51:05,359
and most of the spacecraft hides behind

1382
00:51:09,829 --> 00:51:07,119
that the front of the heat shield is at

1383
00:51:11,829 --> 00:51:09,839
like 1800 degrees the back end is sort

1384
00:51:14,309 --> 00:51:11,839
of room temperature and so we can have

1385
00:51:16,150 --> 00:51:14,319
our instruments work and study the sun

1386
00:51:18,630 --> 00:51:16,160
from that close

1387
00:51:21,829 --> 00:51:18,640
you know without being fried by this

1388
00:51:23,190 --> 00:51:21,839

tremendous 625 times the area sun that

1389
00:51:24,630 --> 00:51:23,200
we're going to see

1390
00:51:26,390 --> 00:51:24,640
are you going to actually be inside the

1391
00:51:28,390 --> 00:51:26,400
corona we're going to be inside the

1392
00:51:30,150 --> 00:51:28,400
corona of the sun and

1393
00:51:31,750 --> 00:51:30,160
one of the main questions that solar pro

1394
00:51:33,829 --> 00:51:31,760
plus is meant to answer is you said

1395
00:51:35,589 --> 00:51:33,839
earlier that the corona is hotter than

1396
00:51:37,430 --> 00:51:35,599
the surface of the sun that's really

1397
00:51:39,109 --> 00:51:37,440
weird because normally as you get

1398
00:51:40,230 --> 00:51:39,119
further from a heat source you get

1399
00:51:42,230 --> 00:51:40,240
colder

1400
00:51:44,150 --> 00:51:42,240
why do you get hotter there's theories

1401
00:51:46,069 --> 00:51:44,160
of why this happens but we don't know

1402
00:51:48,150 --> 00:51:46,079
solar probe is going to be in the region

1403
00:51:49,910 --> 00:51:48,160
where the corona is still heating and

1404
00:51:52,470 --> 00:51:49,920
we're going to be for the first time

1405
00:51:53,829 --> 00:51:52,480
able to answer why the corona is so hot

1406
00:51:55,750 --> 00:51:53,839
well i'm looking forward to finding out

1407
00:51:59,589 --> 00:51:55,760
the answers that's what scientists do

1408
00:52:01,750 --> 00:51:59,599
it's it's going to be great 2018 launch

1409
00:52:03,829 --> 00:52:01,760
wonderful and the mission how long

1410
00:52:05,670 --> 00:52:03,839
should will it live it'll last for seven

1411
00:52:07,990 --> 00:52:05,680
years it'll get it'll actually get

1412
00:52:10,069 --> 00:52:08,000
closer and closer using venus to to get

1413
00:52:11,510 --> 00:52:10,079

in closer and closer to the sun so the

1414
00:52:13,270 --> 00:52:11,520
closest approaches aren't until late in

1415
00:52:15,349 --> 00:52:13,280
the mission but even the first go in

1416
00:52:17,190 --> 00:52:15,359
will be closer than any other

1417
00:52:20,230 --> 00:52:17,200
spacecraft there's ever been well thank

1418
00:52:22,309 --> 00:52:20,240
you very much thank you dr christian and

1419
00:52:24,870 --> 00:52:22,319
and now let's let's uh take a look back

1420
00:52:27,190 --> 00:52:24,880
at the landscape around us

1421
00:52:29,349 --> 00:52:27,200
lots of people wonderful coming down

1422
00:52:30,630 --> 00:52:29,359
from that high of totality

1423
00:52:31,510 --> 00:52:30,640
and

1424
00:52:33,829 --> 00:52:31,520
now

1425
00:52:35,910 --> 00:52:33,839
we can actually look up again and see

1426
00:52:36,870 --> 00:52:35,920
that oh it is quite

1427
00:52:40,069 --> 00:52:36,880
uh

1428
00:52:42,710 --> 00:52:40,079
arc of the sun

1429
00:52:44,309 --> 00:52:42,720
wow it's coming back and it's so

1430
00:52:46,630 --> 00:52:44,319
pleasant here with the sun partially

1431
00:52:48,630 --> 00:52:46,640
covered yeah it's a lot better than

1432
00:52:50,390 --> 00:52:48,640
being in the noonday sun on most days

1433
00:52:51,190 --> 00:52:50,400
okay thank you very much dr klein great

1434
00:52:52,950 --> 00:52:51,200
doctor

1435
00:52:54,870 --> 00:52:52,960
yeah thank you

1436
00:52:58,950 --> 00:52:54,880
so i think we're gonna go to the

1437
00:52:58,960 --> 00:53:05,109
off to the telescopes

1438
00:53:09,270 --> 00:53:06,790

so we're taking a look at the telescopes

1439
00:53:11,510 --> 00:53:09,280
now as the sun slowly returns it's

1440
00:53:14,630 --> 00:53:11,520
amazing how quick it turns from that

1441
00:53:15,430 --> 00:53:14,640
very very tiny crescent into a big fat

1442
00:53:17,349 --> 00:53:15,440
one

1443
00:53:19,349 --> 00:53:17,359
um it was interesting i was just off

1444
00:53:21,430 --> 00:53:19,359
camera talking with stanley uh red a

1445
00:53:23,030 --> 00:53:21,440
girl who's been helping us out here and

1446
00:53:25,109 --> 00:53:23,040
he just pointed out a couple i thought

1447
00:53:26,710 --> 00:53:25,119
interesting facts one thing he pointed

1448
00:53:28,309 --> 00:53:26,720
out was that the birds are now doing

1449
00:53:30,069 --> 00:53:28,319
their morning flight routines there's

1450
00:53:31,750 --> 00:53:30,079
been about a half a dozen birds circling

1451
00:53:32,790 --> 00:53:31,760
the runway and he said that's part of

1452
00:53:35,270 --> 00:53:32,800
their normal

1453
00:53:36,549 --> 00:53:35,280
morning routine so they're very confused

1454
00:53:39,910 --> 00:53:36,559
the other thing he mentioned is that

1455
00:53:41,829 --> 00:53:39,920
during totality a lot of and i heard it

1456
00:53:43,670 --> 00:53:41,839
there was actually some consistence in

1457
00:53:45,910 --> 00:53:43,680
the chanting and that the people here

1458
00:53:47,109 --> 00:53:45,920
were doing um one of their traditional

1459
00:53:48,870 --> 00:53:47,119
chants

1460
00:53:51,510 --> 00:53:48,880
that they do whatever they're surprised

1461
00:53:53,270 --> 00:53:51,520
if a stranger shows up on the beach or

1462
00:53:55,670 --> 00:53:53,280
something unusual happens their

1463
00:53:58,230 --> 00:53:55,680

automatic reaction is to sort of make

1464
00:53:59,829 --> 00:53:58,240
this uh this chanting sound over and

1465
00:54:01,430 --> 00:53:59,839
over and it sort of spreads a word

1466
00:54:03,430 --> 00:54:01,440
that's something going on so i thought

1467
00:54:05,190 --> 00:54:03,440
that was really really nice that's just

1468
00:54:06,950 --> 00:54:05,200
great the things you learn as you travel

1469
00:54:09,349 --> 00:54:06,960
the world to the locations of the total

1470
00:54:11,270 --> 00:54:09,359
solar eclipses are amazing it is it's

1471
00:54:13,430 --> 00:54:11,280
been absolutely spectacular and i know

1472
00:54:15,510 --> 00:54:13,440
you and eric were talking about the 2017

1473
00:54:17,510 --> 00:54:15,520
eclipse which is coming up soon and i

1474
00:54:19,910 --> 00:54:17,520
just wanted to say to everyone it's not

1475
00:54:21,670 --> 00:54:19,920
too early to start planning for the

1476
00:54:23,430 --> 00:54:21,680
total solar eclipse and there's a few

1477
00:54:24,950 --> 00:54:23,440
things that we think you might want to

1478
00:54:26,950 --> 00:54:24,960
start doing right now

1479
00:54:29,270 --> 00:54:26,960
one is we sort of recommend that you go

1480
00:54:31,270 --> 00:54:29,280
online and that you get a pair of these

1481
00:54:33,109 --> 00:54:31,280
they're called usually eclipse shades

1482
00:54:34,630 --> 00:54:33,119
you can just google them the ones that

1483
00:54:36,710 --> 00:54:34,640
we got here are actually from a place

1484
00:54:38,549 --> 00:54:36,720
called rainbow symphony symphony but

1485
00:54:40,549 --> 00:54:38,559
there's other companies too because you

1486
00:54:42,230 --> 00:54:40,559
can actually look at the sun every day

1487
00:54:43,990 --> 00:54:42,240
you don't have to wait for an eclipse

1488
00:54:46,069 --> 00:54:44,000

and a lot of times you can actually see

1489
00:54:47,990 --> 00:54:46,079
sun spots on the sun so you can start

1490
00:54:50,549 --> 00:54:48,000
tracking sun spots getting to know the

1491
00:54:53,109 --> 00:54:50,559
sun so when really strange things happen

1492
00:54:55,190 --> 00:54:53,119
like what happened today you'll be ready

1493
00:54:56,710 --> 00:54:55,200
there's another really awesome activity

1494
00:54:58,470 --> 00:54:56,720
that we like to do we do it all the time

1495
00:55:00,710 --> 00:54:58,480
at the exploratorium

1496
00:55:02,950 --> 00:55:00,720
where we create pinhole images to look

1497
00:55:07,589 --> 00:55:02,960
at the sun so we asked troy to come back

1498
00:55:12,710 --> 00:55:09,750
he's setting out his uh his mats and

1499
00:55:15,829 --> 00:55:12,720
getting ready um so he's prepping it we

1500
00:55:18,230 --> 00:55:15,839
actually had a local girl

1501
00:55:20,230 --> 00:55:18,240
from yap micronesia who wove a special

1502
00:55:22,710 --> 00:55:20,240
map for this activity so they're trying

1503
00:55:25,349 --> 00:55:22,720
to get it all set up get their white mat

1504
00:55:26,630 --> 00:55:25,359
into place it works better the shadows

1505
00:55:28,069 --> 00:55:26,640
on white

1506
00:55:29,990 --> 00:55:28,079
all right troy what do you have

1507
00:55:31,910 --> 00:55:30,000
i have a great way

1508
00:55:33,589 --> 00:55:31,920
to show the eclipse if you don't have

1509
00:55:35,750 --> 00:55:33,599
the glasses or if you just like to see

1510
00:55:37,750 --> 00:55:35,760
it through very simple methods one is

1511
00:55:38,950 --> 00:55:37,760
just using a pinhole projector created

1512
00:55:41,270 --> 00:55:38,960
by your fingers

1513
00:55:43,829 --> 00:55:41,280

i'll cross my fingers in a cross-hatch

1514
00:55:45,349 --> 00:55:43,839
fashion like this and then just point it

1515
00:55:47,190 --> 00:55:45,359
down and you'll notice there are

1516
00:55:49,510 --> 00:55:47,200
actually a little eclipses appearing

1517
00:55:51,190 --> 00:55:49,520
where the tiniest holes are and you can

1518
00:55:53,030 --> 00:55:51,200
use your focal length and adjust that

1519
00:55:54,470 --> 00:55:53,040
until you can see the eclipses i made a

1520
00:55:57,510 --> 00:55:54,480
good one right there

1521
00:55:59,589 --> 00:55:57,520
the next way is we had a young lady here

1522
00:56:02,069 --> 00:55:59,599
on wally eye who created a mat just

1523
00:56:03,829 --> 00:56:02,079
above the mat and if you hold it up at a

1524
00:56:05,750 --> 00:56:03,839
certain angle you'll see hundreds of

1525
00:56:08,150 --> 00:56:05,760
eclipses appearing just everywhere on

1526
00:56:09,750 --> 00:56:08,160
the sheet isn't that beautiful

1527
00:56:11,430 --> 00:56:09,760
and then let's see on the camera but it

1528
00:56:13,430 --> 00:56:11,440
looks pretty good yeah

1529
00:56:15,349 --> 00:56:13,440
and then another way is at nasa we're

1530
00:56:17,670 --> 00:56:15,359
working with eric christian and we're

1531
00:56:19,829 --> 00:56:17,680
creating some pinhole projectors out of

1532
00:56:21,990 --> 00:56:19,839
3d printed material and we've been

1533
00:56:23,910 --> 00:56:22,000
experimenting with this just to see if

1534
00:56:25,990 --> 00:56:23,920
we can make these appear in a good way

1535
00:56:28,470 --> 00:56:26,000
that you can print them out as an stl

1536
00:56:30,390 --> 00:56:28,480
file and then share them the other idea

1537
00:56:32,309 --> 00:56:30,400
we'd like to do with these is create a

1538
00:56:34,309 --> 00:56:32,319

file online that you can place your

1539
00:56:37,349 --> 00:56:34,319
monogram or any symbol that you would

1540
00:56:39,030 --> 00:56:37,359
like inside this type of shape download

1541
00:56:40,549 --> 00:56:39,040
it and then when the eclipse occurs

1542
00:56:42,470 --> 00:56:40,559
you'll be able to create a beautiful

1543
00:56:44,710 --> 00:56:42,480
picture that you can do selfies and pics

1544
00:56:46,630 --> 00:56:44,720
for all of us to see all right troy

1545
00:56:48,309 --> 00:56:46,640
thank you so much so we only have a few

1546
00:56:50,230 --> 00:56:48,319
minutes left and i'd actually like to

1547
00:56:52,470 --> 00:56:50,240
leave everybody with some images of the

1548
00:56:54,950 --> 00:56:52,480
sun but before i do that of course we'd

1549
00:56:56,710 --> 00:56:54,960
like to say thank nasa and the national

1550
00:56:59,190 --> 00:56:56,720
science foundation for making this

1551
00:57:00,950 --> 00:56:59,200
entire broadcast possible and we'd also

1552
00:57:02,950 --> 00:57:00,960
like to sort of give a shout out to the

1553
00:57:06,789 --> 00:57:02,960
folks back at the exploratorium thanks

1554
00:57:08,710 --> 00:57:06,799
so much to the ho the home team yay

1555
00:57:10,390 --> 00:57:08,720
thanks for all of your help and support

1556
00:57:12,710 --> 00:57:10,400
so with that we're just going to leave

1557
00:57:14,470 --> 00:57:12,720
you with some beautiful views of the

1558
00:57:17,109 --> 00:57:14,480
receding moon

1559
00:57:19,349 --> 00:57:17,119
as it moves away

1560
00:57:21,750 --> 00:57:19,359
restoring the sun to us

1561
00:58:17,430 --> 00:57:21,760
saved once again by the laws of

1562
00:58:17,440 --> 00:58:22,069
okay