
VENUS
VENUS

1
00:00:12,549 --> 00:00:11,350
the last one was less than a decade ago

2
00:00:19,830 --> 00:00:12,559
before then

3
00:00:23,990 --> 00:00:21,269
and the next time

4
00:00:26,550 --> 00:00:24,000
it'll be 2117

5
00:00:28,550 --> 00:00:26,560
when few if any of us will be alive to

6
00:00:30,950 --> 00:00:28,560
see it

7
00:00:33,750 --> 00:00:30,960
among the most rare and predictable

8
00:00:36,150 --> 00:00:33,760
celestial events the sight of the planet

9
00:00:37,670 --> 00:00:36,160
venus slowly trekking across the face of

10
00:00:40,549 --> 00:00:37,680
the sun

11
00:00:44,470 --> 00:00:40,559
has been witnessed by humans only 53

12
00:00:46,389 --> 00:00:44,480
times since 2000 years bc

13
00:00:48,310 --> 00:00:46,399

what about the heavens have these

14
00:00:50,470 --> 00:00:48,320
phenomena taught us

15
00:00:53,029 --> 00:00:50,480
and what else might we discover about

16
00:00:57,430 --> 00:00:53,039
our place in the universe during these

17
00:01:25,030 --> 00:00:59,910
the venus transit 2012

18
00:01:30,390 --> 00:01:27,910
almost four hours into our 2012 venus

19
00:01:34,310 --> 00:01:30,400
transit you're looking at a live picture

20
00:01:36,950 --> 00:01:34,320
a live feed from norway cameras there of

21
00:01:38,710 --> 00:01:36,960
the venus transit you can see of course

22
00:01:41,670 --> 00:01:38,720
that dot

23
00:01:44,630 --> 00:01:41,680
across the sun the face of the sun and

24
00:01:47,030 --> 00:01:44,640
uh we've got about two hours and 45

25
00:01:47,830 --> 00:01:47,040
minutes left but for now let's come back

26
00:01:49,910 --> 00:01:47,840
here

27
00:01:52,710 --> 00:01:49,920
alphyberg nasa tv

28
00:01:55,109 --> 00:01:52,720
dwayne brown our science mission

29
00:01:57,190 --> 00:01:55,119
directorate lead public affairs officer

30
00:02:00,469 --> 00:01:57,200
in the office of communications and with

31
00:02:03,350 --> 00:02:00,479
us our planetary division uh director

32
00:02:04,550 --> 00:02:03,360
for nasa dr jim green uh we've got a lot

33
00:02:06,389 --> 00:02:04,560
of cool stuff to show you in the next

34
00:02:08,550 --> 00:02:06,399
few minutes we're going to go halfway

35
00:02:10,550 --> 00:02:08,560
around the world in a couple of minutes

36
00:02:13,110 --> 00:02:10,560
but first we're gonna go over to our our

37
00:02:14,630 --> 00:02:13,120
media maven our social media maven mr

38
00:02:16,470 --> 00:02:14,640

jason townsend who's got some really

39
00:02:18,390 --> 00:02:16,480
cool stuff to show us jason

40
00:02:19,830 --> 00:02:18,400
hi everybody how's everybody doing we're

41
00:02:21,270 --> 00:02:19,840
we're more than halfway through now at

42
00:02:23,110 --> 00:02:21,280
this point and we've got a couple of

43
00:02:24,949 --> 00:02:23,120
things that we wanted to share with you

44
00:02:27,670 --> 00:02:24,959
uh first up you know if you're following

45
00:02:29,270 --> 00:02:27,680
at nasa underscore sdo the solar

46
00:02:31,350 --> 00:02:29,280
dynamics observatory they are releasing

47
00:02:34,070 --> 00:02:31,360
images up there uh we've just got the

48
00:02:37,430 --> 00:02:34,080
latest one coming in um which shows it

49
00:02:39,589 --> 00:02:37,440
about halfway through if then we uh are

50
00:02:42,309 --> 00:02:39,599
also getting some video in from seo and

51
00:02:44,550 --> 00:02:42,319
this is really really cool stuff i mean

52
00:02:46,869 --> 00:02:44,560
this is some awesome video if we can

53
00:02:48,470 --> 00:02:46,879
if we can roll on the video here uh it's

54
00:02:51,350 --> 00:02:48,480
available on youtube we've tweeted it

55
00:02:53,430 --> 00:02:51,360
out it's on at nasa here it is and uh

56
00:02:55,670 --> 00:02:53,440
you can see this the venus is coming

57
00:02:57,430 --> 00:02:55,680
into the sun here for ingress

58
00:02:59,910 --> 00:02:57,440
it's going to cut away here in just a

59
00:03:02,070 --> 00:02:59,920
second to a what much wider shot so you

60
00:03:02,869 --> 00:03:02,080
can see the uh half the sun there and

61
00:03:04,790 --> 00:03:02,879
then

62
00:03:06,710 --> 00:03:04,800
it's gonna finish with the full disc

63
00:03:09,830 --> 00:03:06,720

here and so on so it's absolutely

64
00:03:10,710 --> 00:03:09,840
wonderful wonderful video coming in from

65
00:03:13,270 --> 00:03:10,720
uh

66
00:03:14,869 --> 00:03:13,280
the solar dynamics observatory other

67
00:03:16,790 --> 00:03:14,879
thing that we've got going on here we've

68
00:03:18,309 --> 00:03:16,800
got uh new images that people are

69
00:03:19,750 --> 00:03:18,319
uploading to our flickr group so if

70
00:03:22,070 --> 00:03:19,760
you're taking photos out there make sure

71
00:03:24,550 --> 00:03:22,080
to share them on flickr if you search on

72
00:03:26,229 --> 00:03:24,560
flickr for the group venus transit you

73
00:03:27,830 --> 00:03:26,239
can put your images up there here's a

74
00:03:29,270 --> 00:03:27,840
couple of the ones that we've got from

75
00:03:30,789 --> 00:03:29,280
that group

76
00:03:35,830 --> 00:03:30,799
first up

77
00:03:38,309 --> 00:03:35,840
got a wonderful picture of uh the sun

78
00:03:39,509 --> 00:03:38,319
with venus uh just beginning to appear

79
00:03:41,910 --> 00:03:39,519
there with a little bit of you know

80
00:03:44,789 --> 00:03:41,920
cloudiness the next one we've got going

81
00:03:47,350 --> 00:03:44,799
on here is a wonderful wonderful zoomed

82
00:03:50,149 --> 00:03:47,360
in view here that another user took on

83
00:03:52,630 --> 00:03:50,159
flickr and then our our final shot here

84
00:03:55,270 --> 00:03:52,640
is a different way of looking at the sun

85
00:03:56,789 --> 00:03:55,280
in that it's being um focused onto a

86
00:03:58,229 --> 00:03:56,799
piece of paper here so you're not

87
00:04:00,390 --> 00:03:58,239
actually staring at it remember if

88
00:04:02,070 --> 00:04:00,400

you're online or you are

89
00:04:03,830 --> 00:04:02,080
out looking at the venus transit to make

90
00:04:05,910 --> 00:04:03,840
sure you're doing it safely one of the

91
00:04:08,070 --> 00:04:05,920
big questions that we've been having is

92
00:04:10,070 --> 00:04:08,080
where can we just get pictures live of

93
00:04:11,509 --> 00:04:10,080
this so we've got tons of webcams from

94
00:04:13,670 --> 00:04:11,519
all over the globe if you check out

95
00:04:15,270 --> 00:04:13,680
venustransit.nasa.gov

96
00:04:16,629 --> 00:04:15,280
you can see all of those that are out

97
00:04:18,469 --> 00:04:16,639
there but make sure you're following

98
00:04:20,550 --> 00:04:18,479
along joining the conversation using the

99
00:04:21,909 --> 00:04:20,560
hashtag poundvenustransit

100
00:04:23,590 --> 00:04:21,919
so that's what we've got right now

101
00:04:25,749 --> 00:04:23,600
cooking on social media follow along

102
00:04:27,670 --> 00:04:25,759
with us on nasa nasa on facebook and

103
00:04:29,430 --> 00:04:27,680
nasa on google plus and we're going to

104
00:04:32,150 --> 00:04:29,440
turn it back over to these guys now

105
00:04:33,909 --> 00:04:32,160
thank you jason and gentlemen we are now

106
00:04:35,749 --> 00:04:33,919
going to go halfway around the world

107
00:04:38,150 --> 00:04:35,759
actually the other side of the world

108
00:04:40,629 --> 00:04:38,160
where it is probably close to one or two

109
00:04:42,390 --> 00:04:40,639
o'clock tomorrow afternoon in alice

110
00:04:45,510 --> 00:04:42,400
springs northern territory

111
00:05:09,029 --> 00:04:45,520
australia uh is michael johnson there

112
00:05:13,270 --> 00:05:11,590
the weather looks very nice out there

113
00:05:15,749 --> 00:05:13,280

those kids are from the centralia middle

114
00:05:18,310 --> 00:05:15,759
school springs welcome

115
00:05:20,950 --> 00:05:18,320
to from australia we're here it's now

116
00:05:24,310 --> 00:05:20,960
almost 11 30. we've just gone past the

117
00:05:27,110 --> 00:05:24,320
midpoint of the transit here i'm in

118
00:05:29,430 --> 00:05:27,120
beautiful alice springs uh australia

119
00:05:31,510 --> 00:05:29,440
here in the northern territory behind me

120
00:05:33,830 --> 00:05:31,520
i have students from centralian middle

121
00:05:37,110 --> 00:05:33,840
school who have been hosting us all week

122
00:05:38,950 --> 00:05:37,120
for activities say hi guys hi

123
00:05:41,430 --> 00:05:38,960
my name's phil

124
00:05:43,749 --> 00:05:41,440
there's bill and bob hey we're

125
00:05:46,629 --> 00:05:43,759
we picked us australia here for two

126
00:05:48,790 --> 00:05:46,639
reasons the first one was is that we can

127
00:05:50,950 --> 00:05:48,800
actually see the entire transit

128
00:05:53,510 --> 00:05:50,960
the second one was because of the

129
00:05:56,230 --> 00:05:53,520
weather it is absolutely gorgeous right

130
00:05:58,469 --> 00:05:56,240
now weather it's towards their their uh

131
00:05:59,830 --> 00:05:58,479
southern winter it's the temperatures

132
00:06:01,830 --> 00:05:59,840
perfect

133
00:06:03,189 --> 00:06:01,840
except this morning we had clouds so if

134
00:06:04,390 --> 00:06:03,199
you were watching our feed a little bit

135
00:06:06,790 --> 00:06:04,400
this morning you saw a little bit of

136
00:06:08,550 --> 00:06:06,800
clouds but there is just a few clouds in

137
00:06:11,110 --> 00:06:08,560
the sky and we are set up for an

138
00:06:12,230 --> 00:06:11,120

absolutely gorgeous first and second

139
00:06:13,189 --> 00:06:12,240
contact

140
00:06:14,870 --> 00:06:13,199
i

141
00:06:16,629 --> 00:06:14,880
want to let you know that we have been

142
00:06:18,309 --> 00:06:16,639
working with students all week we've

143
00:06:20,629 --> 00:06:18,319
been teaching them lessons we've been

144
00:06:23,510 --> 00:06:20,639
talking about what is a transit

145
00:06:25,749 --> 00:06:23,520
we've been showing them how to uh

146
00:06:27,029 --> 00:06:25,759
a little bit about the parallax angle so

147
00:06:29,029 --> 00:06:27,039
let me tell you a little bit about that

148
00:06:31,510 --> 00:06:29,039
now if you know that we actually measure

149
00:06:33,270 --> 00:06:31,520
the distance to the sun by using a

150
00:06:35,510 --> 00:06:33,280
parallax angle so we have two different

151
00:06:37,590 --> 00:06:35,520
positions that were on our expedition we

152
00:06:40,950 --> 00:06:37,600
have one in the gopi desert and one here

153
00:06:43,350 --> 00:06:40,960
in australia with these guys yeah again

154
00:06:45,350 --> 00:06:43,360
see with these guys here

155
00:06:48,469 --> 00:06:45,360
if you go ahead and take your thumb

156
00:06:51,110 --> 00:06:48,479
and place it out to an object far away

157
00:06:53,029 --> 00:06:51,120
and cover it close one eye and cover it

158
00:06:54,309 --> 00:06:53,039
and then blink back and forth

159
00:06:55,830 --> 00:06:54,319
you'll notice that your thumb will

160
00:06:58,309 --> 00:06:55,840
actually move position to where you can

161
00:07:00,150 --> 00:06:58,319
actually see the object well knowing

162
00:07:01,909 --> 00:07:00,160
that distance there we can actually do

163
00:07:04,230 --> 00:07:01,919

some trigonometry and find out the

164
00:07:06,309 --> 00:07:04,240
distance to the to the sun from the

165
00:07:08,070 --> 00:07:06,319
earth now that's already been done

166
00:07:09,510 --> 00:07:08,080
before so why do we want to redo it

167
00:07:12,550 --> 00:07:09,520
again well what's the best part of

168
00:07:14,230 --> 00:07:12,560
science replicating our data making sure

169
00:07:16,550 --> 00:07:14,240
that everything we do

170
00:07:18,469 --> 00:07:16,560
is consistently correct

171
00:07:19,749 --> 00:07:18,479
because if hey if we find something

172
00:07:21,430 --> 00:07:19,759
something wrong this time which i don't

173
00:07:23,510 --> 00:07:21,440
think we will

174
00:07:25,430 --> 00:07:23,520
but you know hey there may be something

175
00:07:27,270 --> 00:07:25,440
different we're looking our cameras

176
00:07:29,510 --> 00:07:27,280
right now you see this telescope is

177
00:07:31,670 --> 00:07:29,520
actually a calcium telescope so it's

178
00:07:34,390 --> 00:07:31,680
looking at the sun in the element of

179
00:07:35,830 --> 00:07:34,400
calcium in the in the uh

180
00:07:38,150 --> 00:07:35,840
in the scope

181
00:07:40,309 --> 00:07:38,160
what's really interesting is i don't

182
00:07:42,070 --> 00:07:40,319
know what's going to happen at third and

183
00:07:43,670 --> 00:07:42,080
fourth contact with that atmosphere some

184
00:07:46,390 --> 00:07:43,680
of you were watching before and you saw

185
00:07:47,589 --> 00:07:46,400
the with the nice hydrogen alpha you saw

186
00:07:50,230 --> 00:07:47,599
the the

187
00:07:52,710 --> 00:07:50,240
atmosphere of venus reflecting around

188
00:07:54,390 --> 00:07:52,720

and you saw the the black drop effect

189
00:07:56,790 --> 00:07:54,400
well that was all in kind of what's

190
00:07:57,990 --> 00:07:56,800
called a hydrogen alpha so it's looking

191
00:08:00,230 --> 00:07:58,000
at hydrogen this one's looking at

192
00:08:01,670 --> 00:08:00,240
calcium and since we missed it this

193
00:08:03,270 --> 00:08:01,680
morning i don't know what's going to

194
00:08:04,950 --> 00:08:03,280
happen with that black drop effect with

195
00:08:06,469 --> 00:08:04,960
that i'm hoping it's all the same it may

196
00:08:08,790 --> 00:08:06,479
be cooler i don't know that's the

197
00:08:13,510 --> 00:08:08,800
mystery of science

198
00:08:17,589 --> 00:08:15,430
again we're still we're here at alice

199
00:08:19,670 --> 00:08:17,599
springs check out our website for other

200
00:08:25,430 --> 00:08:19,680
for our other streams uh you can see

201
00:08:31,029 --> 00:08:28,950
stay tuned here on this webcast for uh

202
00:08:32,790 --> 00:08:31,039
updates and things i i'll come up to

203
00:08:34,389 --> 00:08:32,800
take a look at some of the other sites

204
00:08:36,310 --> 00:08:34,399
when you look at the other sites look at

205
00:08:38,630 --> 00:08:36,320
something in particular look at where

206
00:08:41,029 --> 00:08:38,640
the sun is or where venus is crossing

207
00:08:43,190 --> 00:08:41,039
the sun in each one i bet you that's a

208
00:08:44,870 --> 00:08:43,200
it's a little bit different also look at

209
00:08:47,590 --> 00:08:44,880
the time

210
00:08:51,030 --> 00:08:47,600
we're planning on it our exit our egress

211
00:08:53,590 --> 00:08:51,040
starts about 157 here in uh in alice

212
00:08:55,910 --> 00:08:53,600
springs in other places it actually

213
00:08:57,590 --> 00:08:55,920

happens a little bit later well when

214
00:08:59,110 --> 00:08:57,600
when you think of why it does that well

215
00:09:01,509 --> 00:08:59,120
it's because we're looking from all

216
00:09:03,750 --> 00:09:01,519
different angles and again those angles

217
00:09:06,389 --> 00:09:03,760
are how we measure those distances ready

218
00:09:07,910 --> 00:09:06,399
to wrap all right

219
00:09:10,470 --> 00:09:07,920
i'm glad you guys have joined us from

220
00:09:19,750 --> 00:09:10,480
alice springs one more time say bye from

221
00:09:19,760 --> 00:09:24,070
but uh you like our feed

222
00:09:27,670 --> 00:09:26,070
michael johnson from the coca-cola space

223
00:09:30,150 --> 00:09:27,680
science center columbus state university

224
00:09:31,590 --> 00:09:30,160
in georgia with the centralian middle

225
00:09:33,509 --> 00:09:31,600
school students in alice springs

226
00:09:37,030 --> 00:09:33,519
northern territory australia

227
00:09:38,949 --> 00:09:37,040
uh great time down there

228
00:09:40,710 --> 00:09:38,959
a lot of fun you know we're gonna uh

229
00:09:42,790 --> 00:09:40,720
we're joined again as we said earlier

230
00:09:45,190 --> 00:09:42,800
about with jim green but i want to send

231
00:09:47,829 --> 00:09:45,200
a shout out to all the nasa centers who

232
00:09:50,389 --> 00:09:47,839
have been participating holding events

233
00:09:52,870 --> 00:09:50,399
and clearly this thing and this this

234
00:09:54,710 --> 00:09:52,880
event is worldwide but at nasa centers

235
00:09:56,630 --> 00:09:54,720
across the country and all kinds of

236
00:09:58,470 --> 00:09:56,640
things going on they're doing some great

237
00:10:01,350 --> 00:09:58,480
things and if you guys are listening out

238
00:10:03,829 --> 00:10:01,360

there and i'm sure you are great job and

239
00:10:06,790 --> 00:10:03,839
uh we still have uh a lot more to go

240
00:10:08,949 --> 00:10:06,800
before we end up um jim

241
00:10:11,670 --> 00:10:08,959
a couple of things on what people are

242
00:10:13,350 --> 00:10:11,680
saying we in the previous segment we saw

243
00:10:16,870 --> 00:10:13,360
the little black dot

244
00:10:19,509 --> 00:10:16,880
uh explain to folks because uh when the

245
00:10:21,110 --> 00:10:19,519
when the um the telescopes look at the

246
00:10:22,870 --> 00:10:21,120
sun it's like flipped or there's

247
00:10:24,790 --> 00:10:22,880
something going on there where the dots

248
00:10:27,110 --> 00:10:24,800
should be here but it's there explain

249
00:10:27,990 --> 00:10:27,120
what what's going on in that situation

250
00:10:29,750 --> 00:10:28,000
well

251
00:10:32,710 --> 00:10:29,760
telescopes are a little bit different

252
00:10:34,470 --> 00:10:32,720
than binoculars you know with binoculars

253
00:10:37,030 --> 00:10:34,480
you can look through them and everything

254
00:10:39,829 --> 00:10:37,040
looks right it just looks magnified but

255
00:10:41,430 --> 00:10:39,839
with telescopes they actually

256
00:10:45,590 --> 00:10:41,440
flip things

257
00:10:47,670 --> 00:10:45,600
and that's why uh venus as it entered

258
00:10:49,910 --> 00:10:47,680
the disc wasn't exactly where everyone

259
00:10:52,790 --> 00:10:49,920
thought it was in addition to that as

260
00:10:54,550 --> 00:10:52,800
telescopes are are also rigged up with

261
00:10:56,470 --> 00:10:54,560
cameras and other types of feeds and

262
00:10:57,509 --> 00:10:56,480
they have a certain orientation and they

263
00:11:00,710 --> 00:10:57,519

track

264
00:11:03,350 --> 00:11:00,720
uh the sun across the sky

265
00:11:04,710 --> 00:11:03,360
then they're not actually looking at the

266
00:11:07,110 --> 00:11:04,720
sun

267
00:11:09,350 --> 00:11:07,120
and its rotational axis so sometimes

268
00:11:11,910 --> 00:11:09,360
north and south on the sun would exactly

269
00:11:15,590 --> 00:11:11,920
be north and south as you see it

270
00:11:17,430 --> 00:11:15,600
so when you look at the venus transit

271
00:11:19,910 --> 00:11:17,440
you have to really compare it to things

272
00:11:22,630 --> 00:11:19,920
like what sdo is is observing and

273
00:11:25,190 --> 00:11:22,640
posting that's uh that that's all been

274
00:11:28,710 --> 00:11:25,200
rectified and it looks beautiful

275
00:11:31,190 --> 00:11:28,720
you can also look at the set of sunspots

276
00:11:32,710 --> 00:11:31,200
the sunspots because we're going up to

277
00:11:34,230 --> 00:11:32,720
solar maximum

278
00:11:36,150 --> 00:11:34,240
increase

279
00:11:37,910 --> 00:11:36,160
and there there's typically a line of

280
00:11:40,310 --> 00:11:37,920
those sunspots

281
00:11:42,470 --> 00:11:40,320
at a certain latitude both in the

282
00:11:45,110 --> 00:11:42,480
northern and southern hemisphere and as

283
00:11:47,350 --> 00:11:45,120
you get down to solar maximum the

284
00:11:51,190 --> 00:11:47,360
latitude of those sunspots get closer

285
00:11:54,470 --> 00:11:51,200
and closer to about 20 or 15 degrees

286
00:11:57,110 --> 00:11:54,480
latitude on the sun and so consequently

287
00:11:59,590 --> 00:11:57,120
you don't really see sunspots along the

288
00:12:02,069 --> 00:11:59,600

equator so you add all those things up

289
00:12:04,870 --> 00:12:02,079
and you can actually tell and predict

290
00:12:06,310 --> 00:12:04,880
the orientation of the sun you can see

291
00:12:08,790 --> 00:12:06,320
how the

292
00:12:11,350 --> 00:12:08,800
optical systems have flipped it and then

293
00:12:13,750 --> 00:12:11,360
you can say okay venus is going to go

294
00:12:16,870 --> 00:12:13,760
from one side to another and then watch

295
00:12:18,790 --> 00:12:16,880
it over time and indeed that confirms uh

296
00:12:21,590 --> 00:12:18,800
uh actually what's going on with those

297
00:12:25,590 --> 00:12:21,600
particular images jim let's go right now

298
00:12:28,389 --> 00:12:25,600
to this image which is correct if i am

299
00:12:30,790 --> 00:12:28,399
correct this is our first look at mount

300
00:12:32,870 --> 00:12:30,800
wilson from mount wilson observatory in

301
00:12:35,750 --> 00:12:32,880
california in the angelis national

302
00:12:38,870 --> 00:12:35,760
forest in california 60 inch telescope

303
00:12:40,550 --> 00:12:38,880
and this is the venus transit 2012 live

304
00:12:42,150 --> 00:12:40,560
from that perspective we see some

305
00:12:44,150 --> 00:12:42,160
sunspots over to the right there's

306
00:12:46,629 --> 00:12:44,160
sunspots way over to the right but what

307
00:12:49,829 --> 00:12:46,639
you notice more than anything else is a

308
00:12:52,629 --> 00:12:49,839
lot of the atmospheric turbulence okay

309
00:12:55,829 --> 00:12:52,639
so this must be late in the day so we

310
00:12:58,790 --> 00:12:55,839
must be seeing the rising air currents

311
00:13:01,670 --> 00:12:58,800
that's uh moving up in the in

312
00:13:04,150 --> 00:13:01,680
in our view and consequently it changes

313
00:13:06,230 --> 00:13:04,160

the index of refraction

314
00:13:07,990 --> 00:13:06,240
but all it does really is move those

315
00:13:10,870 --> 00:13:08,000
images around a little bit so we don't

316
00:13:13,509 --> 00:13:10,880
really see a very crisp nice beautiful

317
00:13:15,910 --> 00:13:13,519
black dot the venus would be nor do we

318
00:13:17,670 --> 00:13:15,920
see exactly the sunspots the way they

319
00:13:20,790 --> 00:13:17,680
they would appear they don't really move

320
00:13:22,949 --> 00:13:20,800
like that now just does that affect our

321
00:13:25,190 --> 00:13:22,959
gathering of scientific data yes

322
00:13:26,230 --> 00:13:25,200
actually it does it changes our timing a

323
00:13:28,150 --> 00:13:26,240
little bit

324
00:13:31,910 --> 00:13:28,160
uh that's why one of the reasons why we

325
00:13:34,470 --> 00:13:31,920
do want to observe it uh off this planet

326
00:13:37,350 --> 00:13:34,480
and in fact don pettit is in the space

327
00:13:39,030 --> 00:13:37,360
station observing it now and and so he

328
00:13:41,189 --> 00:13:39,040
won't have any of the atmospheric

329
00:13:42,550 --> 00:13:41,199
effects that we have on the ground

330
00:13:44,949 --> 00:13:42,560
now what we've been doing is

331
00:13:48,389 --> 00:13:44,959
accumulating a lot of these images many

332
00:13:51,269 --> 00:13:48,399
of that we possibly can on our website

333
00:13:53,910 --> 00:13:51,279
venustransit.nasa.gov

334
00:13:55,829 --> 00:13:53,920
and uh what we'd like to do over time is

335
00:13:58,069 --> 00:13:55,839
be able to use that data that's come in

336
00:14:00,389 --> 00:13:58,079
from many different sources now yeah

337
00:14:02,150 --> 00:14:00,399
that's a beautiful one that's from sdo

338
00:14:04,150 --> 00:14:02,160

see that's just beautiful

339
00:14:06,710 --> 00:14:04,160
it's very close to white light if

340
00:14:08,389 --> 00:14:06,720
meaning how you would observe it if if

341
00:14:10,790 --> 00:14:08,399
you were at the right location at the

342
00:14:13,110 --> 00:14:10,800
moment seeing this but what's really

343
00:14:15,829 --> 00:14:13,120
spectacular about this one you know

344
00:14:18,389 --> 00:14:15,839
though it's very simple you see this you

345
00:14:20,550 --> 00:14:18,399
see the beautiful venus which is really

346
00:14:22,790 --> 00:14:20,560
look like it's carved out

347
00:14:25,110 --> 00:14:22,800
uh the light from the sun it's really

348
00:14:28,069 --> 00:14:25,120
blocked it well but then compare that

349
00:14:31,189 --> 00:14:28,079
against the sun spots you see the the

350
00:14:34,230 --> 00:14:31,199
dark area that's called the umbra of the

351
00:14:36,949 --> 00:14:34,240
sunspot and then around that is the

352
00:14:38,949 --> 00:14:36,959
penumbra and that is

353
00:14:40,629 --> 00:14:38,959
not quite as dark and that tells you

354
00:14:43,910 --> 00:14:40,639
this that gives you a great idea what

355
00:14:46,230 --> 00:14:43,920
the structure of the sunspots are how

356
00:14:48,310 --> 00:14:46,240
big would that sunspot be well if i if

357
00:14:51,350 --> 00:14:48,320
you took the earth and you actually

358
00:14:53,430 --> 00:14:51,360
moved it all the way to the sun

359
00:14:56,150 --> 00:14:53,440
yes any one of those little bitty

360
00:14:58,389 --> 00:14:56,160
sunspots off to the side would be about

361
00:15:00,470 --> 00:14:58,399
the size of the earth really so yeah so

362
00:15:02,389 --> 00:15:00,480
that larger one that's enormous that's

363
00:15:04,550 --> 00:15:02,399

much bigger than the earth

364
00:15:06,790 --> 00:15:04,560
uh and in fact

365
00:15:09,189 --> 00:15:06,800
we're coming towards solar maximum now

366
00:15:11,829 --> 00:15:09,199
so we would expect to see more and more

367
00:15:14,069 --> 00:15:11,839
magnetic activity we would expect to see

368
00:15:17,030 --> 00:15:14,079
bigger and larger sunspots

369
00:15:19,269 --> 00:15:17,040
and about every other cycle

370
00:15:20,389 --> 00:15:19,279
some of these sunspots get to be so

371
00:15:23,110 --> 00:15:20,399
enormous

372
00:15:25,829 --> 00:15:23,120
that they could rival the size of that

373
00:15:27,750 --> 00:15:25,839
projected image of venus on the sun and

374
00:15:29,749 --> 00:15:27,760
those are just enormous and that's why

375
00:15:31,749 --> 00:15:29,759
when you have the glasses

376
00:15:34,629 --> 00:15:31,759
even even though you may use these

377
00:15:37,030 --> 00:15:34,639
during venus transit you can use these

378
00:15:39,590 --> 00:15:37,040
anytime so you can really look at the

379
00:15:42,389 --> 00:15:39,600
sun particularly around solar maximum

380
00:15:44,629 --> 00:15:42,399
and you might be able to see sunspots

381
00:15:46,790 --> 00:15:44,639
nearly the size of the projected image

382
00:15:47,670 --> 00:15:46,800
of venus that we see here now

383
00:15:50,150 --> 00:15:47,680
and

384
00:15:50,949 --> 00:15:50,160
to keep things in perspective literally

385
00:15:52,150 --> 00:15:50,959
yeah

386
00:15:55,350 --> 00:15:52,160
venus

387
00:15:56,790 --> 00:15:55,360
is not nearly as big in actuality as

388
00:15:58,870 --> 00:15:56,800

those sunspots

389
00:16:01,350 --> 00:15:58,880
oh yeah venus is itty bitty compared to

390
00:16:04,389 --> 00:16:01,360
those if you move venus all the way to

391
00:16:07,269 --> 00:16:04,399
the sun now venus is like two-thirds of

392
00:16:10,629 --> 00:16:07,279
an astronomical unit you know we're one

393
00:16:13,509 --> 00:16:10,639
a you away that's 93 million miles venus

394
00:16:16,069 --> 00:16:13,519
is more like 67 million miles away from

395
00:16:18,389 --> 00:16:16,079
the sun so if you moved uh

396
00:16:20,870 --> 00:16:18,399
venus to the sun it would shrink and

397
00:16:22,550 --> 00:16:20,880
shrink and shrink and become

398
00:16:24,870 --> 00:16:22,560
about the size of one of those little

399
00:16:25,990 --> 00:16:24,880
bitty dots that that that are associated

400
00:16:27,829 --> 00:16:26,000
with that bigger

401
00:16:29,189 --> 00:16:27,839
sunspot here we're back at mount wilson

402
00:16:30,629 --> 00:16:29,199
with a wide shot you can see everybody

403
00:16:32,150 --> 00:16:30,639
with their telescopes they are they're

404
00:16:33,749 --> 00:16:32,160
enjoying that view i wonder if we can

405
00:16:34,790 --> 00:16:33,759
put on our glasses now would we say

406
00:16:37,189 --> 00:16:34,800
anything

407
00:16:39,269 --> 00:16:37,199
it'd be pretty dark they're designed to

408
00:16:41,990 --> 00:16:39,279
be that way by the way because the sun

409
00:16:43,670 --> 00:16:42,000
is indeed quite intense it's one of the

410
00:16:45,910 --> 00:16:43,680
reasons why you don't even want to look

411
00:16:48,389 --> 00:16:45,920
at it with your naked eye

412
00:16:49,990 --> 00:16:48,399
sometimes late in the late in the day

413
00:16:52,710 --> 00:16:50,000

you know where there's a lot of smog you

414
00:16:55,189 --> 00:16:52,720
might look and and and you know see see

415
00:16:57,509 --> 00:16:55,199
the sun but in reality you should avoid

416
00:16:59,189 --> 00:16:57,519
doing that it's uh it can be harmful to

417
00:17:01,829 --> 00:16:59,199
your to your eyesight

418
00:17:04,630 --> 00:17:01,839
and jim um take us back a little bit a

419
00:17:07,270 --> 00:17:04,640
little history lesson here being head of

420
00:17:09,270 --> 00:17:07,280
the planetary division and um the year

421
00:17:11,350 --> 00:17:09,280
of the solar system but you guys have

422
00:17:13,189 --> 00:17:11,360
been studying venus for many years can

423
00:17:15,110 --> 00:17:13,199
you give us a quick snapshot of the

424
00:17:16,789 --> 00:17:15,120
first mission of venus to the president

425
00:17:17,510 --> 00:17:16,799
and we've learned yeah i'll be delighted

426
00:17:19,029 --> 00:17:17,520
to

427
00:17:21,829 --> 00:17:19,039
in fact you know at the dawn of the

428
00:17:23,750 --> 00:17:21,839
space age right after sputnik uh you

429
00:17:25,590 --> 00:17:23,760
know this uh this nation

430
00:17:28,069 --> 00:17:25,600
and this and the soviet union decided

431
00:17:30,950 --> 00:17:28,079
they were also going to trek out into

432
00:17:34,070 --> 00:17:30,960
the solar system and so we had planned

433
00:17:36,870 --> 00:17:34,080
and launched four lunar probes lunar

434
00:17:40,789 --> 00:17:36,880
rangers one two three and four

435
00:17:44,230 --> 00:17:40,799
by 1962 every one of them failed

436
00:17:45,909 --> 00:17:44,240
by 1962 we also launched a mission

437
00:17:48,230 --> 00:17:45,919
called mariner 1

438
00:17:52,710 --> 00:17:48,240

to venus that failed

439
00:17:55,830 --> 00:17:52,720
but mariner 2 launched in august 1962

440
00:17:57,350 --> 00:17:55,840
nearly 50 years ago was successful and

441
00:17:58,789 --> 00:17:57,360
jim let me let me jump in here don't

442
00:18:00,549 --> 00:17:58,799
hold that story but we just got some

443
00:18:02,230 --> 00:18:00,559
breaking news we got an image from the

444
00:18:04,390 --> 00:18:02,240
international space oh this is wonderful

445
00:18:05,909 --> 00:18:04,400
don don's coming through

446
00:18:08,150 --> 00:18:05,919
don pettit uh

447
00:18:10,630 --> 00:18:08,160
well-known science geek right yeah

448
00:18:14,549 --> 00:18:10,640
and all the most positive uh way of

449
00:18:16,789 --> 00:18:14,559
putting that uh he is uh uh this is crew

450
00:18:18,710 --> 00:18:16,799
sleep as we mentioned earlier but don's

451
00:18:20,390 --> 00:18:18,720
not sleeping because don is so excited

452
00:18:22,630 --> 00:18:20,400
about this hey that's great maybe you

453
00:18:25,110 --> 00:18:22,640
heard that science never sleeps yeah i

454
00:18:26,789 --> 00:18:25,120
bet he's never seen that

455
00:18:29,510 --> 00:18:26,799
jason did you have something else for us

456
00:18:31,510 --> 00:18:29,520
yeah if you if you guys uh want to go

457
00:18:33,270 --> 00:18:31,520
and check it out you can uh hop on to

458
00:18:35,110 --> 00:18:33,280
the at nasa twitter feed you can hop on

459
00:18:36,950 --> 00:18:35,120
to nasa facebook or nasa on google plus

460
00:18:39,350 --> 00:18:36,960
we've just shared the link on flickr

461
00:18:41,590 --> 00:18:39,360
where you can go and get all of the

462
00:18:43,029 --> 00:18:41,600
different images that don pettit has now

463
00:18:45,029 --> 00:18:43,039

put up from the international space

464
00:18:46,470 --> 00:18:45,039
station and as they keep coming in we'll

465
00:18:47,830 --> 00:18:46,480
make sure that we keep uh getting them

466
00:18:49,750 --> 00:18:47,840
out there and sharing them so you guys

467
00:18:52,870 --> 00:18:49,760
can join the conversation just follow

468
00:18:54,950 --> 00:18:52,880
hashtag poundvenustransit so

469
00:18:56,710 --> 00:18:54,960
thanks jason okay so uh dr gray we

470
00:18:58,950 --> 00:18:56,720
wanted to get that that station but give

471
00:19:01,350 --> 00:18:58,960
us a quick again continue on the history

472
00:19:03,669 --> 00:19:01,360
lesson 50 years ago mariner 2 was

473
00:19:04,470 --> 00:19:03,679
successful flew by venus

474
00:19:07,830 --> 00:19:04,480
and

475
00:19:10,870 --> 00:19:07,840
really gave us a great view of it it

476
00:19:13,510 --> 00:19:10,880
tell told us that the clouds were really

477
00:19:16,070 --> 00:19:13,520
impenetrable we couldn't see down to the

478
00:19:18,549 --> 00:19:16,080
ground of venus from the earth and we

479
00:19:19,270 --> 00:19:18,559
couldn't do that from mariner 2.

480
00:19:21,350 --> 00:19:19,280
so

481
00:19:23,990 --> 00:19:21,360
that then launched a whole series of

482
00:19:26,230 --> 00:19:24,000
other scientific investigations and

483
00:19:29,750 --> 00:19:26,240
nearly 20 missions have been launched to

484
00:19:32,310 --> 00:19:29,760
venus over these last 50 years many of

485
00:19:35,669 --> 00:19:32,320
them unsuccessful venus turns out to be

486
00:19:37,990 --> 00:19:35,679
a hard object to really get to know

487
00:19:39,750 --> 00:19:38,000
but fortunately what's happened is

488
00:19:41,270 --> 00:19:39,760

many russian missions were very

489
00:19:45,029 --> 00:19:41,280
successful

490
00:19:46,150 --> 00:19:45,039
venera 13 and 14 actually landed on the

491
00:19:49,590 --> 00:19:46,160
surface

492
00:19:51,909 --> 00:19:49,600
and as lika mentioned earlier today

493
00:19:53,669 --> 00:19:51,919
the temperature of uh the surface

494
00:19:56,870 --> 00:19:53,679
temperature of venus is hot enough to

495
00:19:59,029 --> 00:19:56,880
melt lead the pressure is 90 times that

496
00:20:01,350 --> 00:19:59,039
of our own atmosphere you have to go way

497
00:20:03,270 --> 00:20:01,360
deep into the ocean to get that same

498
00:20:06,870 --> 00:20:03,280
pressure and so

499
00:20:09,750 --> 00:20:06,880
these two big these bathtub like

500
00:20:12,390 --> 00:20:09,760
battleships landing down on the surface

501
00:20:14,870 --> 00:20:12,400
of venus actually only survive for about

502
00:20:17,830 --> 00:20:14,880
an hour and 20 minutes but they gave us

503
00:20:19,990 --> 00:20:17,840
a fantastic view of what that

504
00:20:22,310 --> 00:20:20,000
atmospheric profile was all about and

505
00:20:25,190 --> 00:20:22,320
temperature and density all the way down

506
00:20:27,270 --> 00:20:25,200
to the ground now in addition to that

507
00:20:29,909 --> 00:20:27,280
the russians launched very successfully

508
00:20:33,270 --> 00:20:29,919
several more missions most notably

509
00:20:35,350 --> 00:20:33,280
vega one and two and vega actually

510
00:20:37,669 --> 00:20:35,360
launched balloons

511
00:20:40,470 --> 00:20:37,679
into the atmosphere of venus and you you

512
00:20:43,350 --> 00:20:40,480
watched from ground the balloons uh in

513
00:20:45,830 --> 00:20:43,360

that upper atmosphere uh and they lasted

514
00:20:48,710 --> 00:20:45,840
until they they went around in the in

515
00:20:51,110 --> 00:20:48,720
the super rotation of the wind speed in

516
00:20:53,270 --> 00:20:51,120
fact the wind speed at the the top of

517
00:20:54,710 --> 00:20:53,280
the clouds of venus

518
00:20:57,350 --> 00:20:54,720
is uh uh

519
00:20:58,470 --> 00:20:57,360
in four days can actually transit the

520
00:21:00,470 --> 00:20:58,480
planet

521
00:21:03,430 --> 00:21:00,480
so that's running at an average about

522
00:21:05,590 --> 00:21:03,440
250 miles per hour

523
00:21:07,830 --> 00:21:05,600
so we're talking about hurricane winds

524
00:21:09,190 --> 00:21:07,840
like you can't imagine you know force 10

525
00:21:12,070 --> 00:21:09,200
or something i don't know what it would

526
00:21:14,549 --> 00:21:12,080
be on the scale but

527
00:21:16,310 --> 00:21:14,559
and so those those balloons

528
00:21:18,870 --> 00:21:16,320
made atmospheric measurements and did

529
00:21:22,710 --> 00:21:18,880
wonderful but it really took

530
00:21:25,110 --> 00:21:22,720
the the u.s mission called magellan

531
00:21:28,149 --> 00:21:25,120
to be able to have a ground penetrating

532
00:21:29,590 --> 00:21:28,159
radar after it got in orbit to penetrate

533
00:21:32,870 --> 00:21:29,600
those clouds

534
00:21:34,549 --> 00:21:32,880
and really globally map what the surface

535
00:21:37,990 --> 00:21:34,559
of venus looked like and what year was

536
00:21:39,029 --> 00:21:38,000
that that was in the 80s sorry yes late

537
00:21:41,190 --> 00:21:39,039
80s

538
00:21:42,070 --> 00:21:41,200

and so what happened

539
00:21:45,510 --> 00:21:42,080
is

540
00:21:48,630 --> 00:21:45,520
we found well over a thousand volcanoes

541
00:21:50,549 --> 00:21:48,640
we recognized how volcanic

542
00:21:51,590 --> 00:21:50,559
the surface is

543
00:21:54,310 --> 00:21:51,600
in fact

544
00:21:57,669 --> 00:21:54,320
we believe venus is so volcanic that it

545
00:21:58,950 --> 00:21:57,679
actually resurfaces itself every 900

546
00:22:01,350 --> 00:21:58,960
million years

547
00:22:03,190 --> 00:22:01,360
so uh since it's beginning it may have

548
00:22:06,310 --> 00:22:03,200
done that several times not a place you

549
00:22:08,470 --> 00:22:06,320
want to take a family vacation

550
00:22:10,630 --> 00:22:08,480
it's a it's a pretty tough environment

551
00:22:13,110 --> 00:22:10,640
in fact some of these volcanoes are as

552
00:22:14,630 --> 00:22:13,120
high as our own mount everest

553
00:22:17,830 --> 00:22:14,640
and so

554
00:22:19,990 --> 00:22:17,840
that's just been a spectacular part also

555
00:22:23,430 --> 00:22:20,000
mentioned is there's a layer of sulfuric

556
00:22:26,230 --> 00:22:23,440
acid it's at about 60 kilometers up

557
00:22:28,310 --> 00:22:26,240
and that layer of sulfuric acid actually

558
00:22:31,510 --> 00:22:28,320
forms little rain drops

559
00:22:34,230 --> 00:22:31,520
and they begin to drop as they condense

560
00:22:36,070 --> 00:22:34,240
around dust and then end up actually

561
00:22:38,230 --> 00:22:36,080
evaporating as they get down into the

562
00:22:40,470 --> 00:22:38,240
higher temperature atmosphere and form

563
00:22:42,070 --> 00:22:40,480

this circulation pattern

564
00:22:44,149 --> 00:22:42,080
we got another picture here to show you

565
00:22:45,270 --> 00:22:44,159
and then we're going to uh

566
00:22:47,510 --> 00:22:45,280
bump out

567
00:22:50,070 --> 00:22:47,520
and come back at 12 30. and you're going

568
00:22:51,510 --> 00:22:50,080
to join us jim this is norway

569
00:22:55,029 --> 00:22:51,520
is that right we're going to show you

570
00:22:57,350 --> 00:22:55,039
norway on the way out and we'll be back

571
00:22:59,750 --> 00:22:57,360
at 12 30. jim will be here dwayne of

572
00:23:01,909 --> 00:22:59,760
course and myself al feinberg and jason

573
00:23:06,789 --> 00:23:01,919
and jason townsend so

574
00:23:11,750 --> 00:23:08,870
the future astronomical public will not

575
00:23:14,870 --> 00:23:11,760
be satisfied unless all practical use is

576
00:26:46,870 --> 00:23:14,880
made of the transits of venus of 1874

577
00:27:06,950 --> 00:27:00,710
uh

578
00:27:06,960 --> 00:27:45,909
and that's what happened

579
00:27:45,919 --> 00:28:00,710
educational

580
00:28:00,720 --> 00:28:27,269
pennsylvania

581
00:28:55,590 --> 00:28:31,430
venus is running on the black line

582
00:28:55,600 --> 00:29:05,990
like a silver flame

583
00:29:25,190 --> 00:29:08,549
she's got it

584
00:29:25,200 --> 00:29:53,350
desire

585
00:29:58,549 --> 00:29:55,750
okay and so that's why this is slightly

586
00:30:01,510 --> 00:29:58,559
tilted oh i see so that the tilt is for

587
00:30:03,510 --> 00:30:01,520
uh venus's orbit yes okay

588
00:30:05,350 --> 00:30:03,520

and um

589
00:30:08,230 --> 00:30:05,360
there's a reason why the reason why we

590
00:30:09,750 --> 00:30:08,240
don't see a transit every three every

591
00:30:12,070 --> 00:30:09,760
late the cycle half

592
00:30:13,269 --> 00:30:12,080
years because of the tilt

593
00:30:15,669 --> 00:30:13,279
so um

594
00:30:18,310 --> 00:30:15,679
half of venus's orbit is above earth's

595
00:30:20,549 --> 00:30:18,320
orbit and half is below earth's orbit

596
00:30:22,549 --> 00:30:20,559
so uh two points are too high above the

597
00:30:25,830 --> 00:30:22,559
sun's disk to be seen and two points are

598
00:30:26,950 --> 00:30:25,840
too low uh too low on earth just to be

599
00:30:29,110 --> 00:30:26,960
seen

600
00:30:30,630 --> 00:30:29,120
wow okay my brain just folded but it

601
00:30:31,990 --> 00:30:30,640
could be altitude

602
00:30:35,750 --> 00:30:32,000
now

603
00:30:40,310 --> 00:30:38,710
i this right under the chair when you

604
00:30:42,230 --> 00:30:40,320
no okay so i

605
00:30:44,389 --> 00:30:42,240
one question i have right off the bat is

606
00:30:47,750 --> 00:30:44,399
is you've got this uh letter system a b

607
00:30:49,669 --> 00:30:47,760
c d e right yes so when they uh when

608
00:30:51,190 --> 00:30:49,679
they complete the cycle how many years

609
00:30:53,269 --> 00:30:51,200
would that represent total when they

610
00:30:55,669 --> 00:30:53,279
when they do one full rotation

611
00:30:57,669 --> 00:30:55,679
uh like when they meet back yeah okay so

612
00:31:00,630 --> 00:30:57,679
that would be eight years for earth and

613
00:31:02,950 --> 00:31:00,640

13 years for venus or venus years okay

614
00:31:04,470 --> 00:31:02,960
so now is that is that why we talked

615
00:31:06,789 --> 00:31:04,480
about earlier why we have two venus

616
00:31:08,470 --> 00:31:06,799
transits like in 2004 that would have

617
00:31:11,029 --> 00:31:08,480
been down here right

618
00:31:12,070 --> 00:31:11,039
and then 2012.

619
00:31:14,070 --> 00:31:12,080
i'm sorry

620
00:31:15,990 --> 00:31:14,080
okay

621
00:31:18,549 --> 00:31:16,000
see this this is why we do these

622
00:31:20,549 --> 00:31:18,559
activities okay so this kind of goes

623
00:31:23,269 --> 00:31:20,559
into the next point okay all right okay

624
00:31:25,430 --> 00:31:23,279
yeah sorry i'll step back venus uh is

625
00:31:28,789 --> 00:31:25,440
actually moving slightly faster than 8

626
00:31:31,269 --> 00:31:28,799
13 of an earth year okay so actually

627
00:31:33,909 --> 00:31:31,279
this we say this pentagon

628
00:31:35,350 --> 00:31:33,919
the the corners of the pentagon are

629
00:31:38,470 --> 00:31:35,360
where the

630
00:31:41,750 --> 00:31:38,480
venus passes earth so they match up okay

631
00:31:44,389 --> 00:31:41,760
um if we were to turn it slightly uh

632
00:31:46,789 --> 00:31:44,399
it turns very very slowly so

633
00:31:48,230 --> 00:31:46,799
part of this that that brings uh to

634
00:31:49,430 --> 00:31:48,240
light some of the years that are

635
00:31:50,950 --> 00:31:49,440
involved in this right do you have

636
00:31:53,990 --> 00:31:50,960
another and then the next eight years

637
00:31:54,789 --> 00:31:54,000
it's kind of a little past the line

638
00:31:57,830 --> 00:31:54,799

yes

639
00:31:59,990 --> 00:31:57,840
and with the numbers and dates on it

640
00:32:01,669 --> 00:32:00,000
oh all right see five and a half years

641
00:32:04,230 --> 00:32:01,679
is because it

642
00:32:05,990 --> 00:32:04,240
the points have to align again

643
00:32:08,310 --> 00:32:06,000
back at that point

644
00:32:13,029 --> 00:32:08,320
wow okay another 100 years is starting

645
00:32:18,310 --> 00:32:15,830
it would be this part