
HUBBLE
hangouts
Planetary Aurorae in our Solar System
Thursday, July 17, 2014, 4pm EDT, 8pm UTC

1
00:00:05,780 --> 00:00:03,740
there we go hello everybody and welcome

2
00:00:06,950 --> 00:00:05,790
to our latest hub will hang out my name

3
00:00:08,960 --> 00:00:06,960
is Tony Darnell at work in the space

4
00:00:10,759 --> 00:00:08,970
telescope science institute and today we

5
00:00:11,839 --> 00:00:10,769
have a really interesting hangout plan

6
00:00:13,970 --> 00:00:11,849
for you we're going to be talking with

7
00:00:16,400 --> 00:00:13,980
dr. loretta let me from the university

8
00:00:20,750 --> 00:00:16,410
of paris in mood all about planetary

9
00:00:21,920 --> 00:00:20,760
irori Aurora's Aurora one of those three

10
00:00:24,529 --> 00:00:21,930
are right i'm not sure which one but

11
00:00:26,689 --> 00:00:24,539
they all sound wrong so what we talked

12
00:00:29,179 --> 00:00:26,699
we hope that you will interact with us

13
00:00:32,089 --> 00:00:29,189

and talk about all things planetary

14
00:00:33,440 --> 00:00:32,099
Aurora today ah before I get to the

15
00:00:35,600 --> 00:00:33,450
introductions let me just say very

16
00:00:37,310 --> 00:00:35,610
briefly that you we hope you will

17
00:00:39,110 --> 00:00:37,320
interact with us you will give us

18
00:00:40,910 --> 00:00:39,120
comments and questions where you can do

19
00:00:42,770 --> 00:00:40,920
it in a wide variety of ways the Q&A app

20
00:00:44,690 --> 00:00:42,780
is the best way to do it you can see

21
00:00:46,459 --> 00:00:44,700
that on both google and youtube so you

22
00:00:48,580 --> 00:00:46,469
just click on that thing and type in a

23
00:00:50,779 --> 00:00:48,590
question and it will appear magically on

24
00:00:51,920 --> 00:00:50,789
to our little panel here and i'll be

25
00:00:54,439 --> 00:00:51,930
able to see the question you can also

26
00:00:57,830 --> 00:00:54,449
tweet at us with Hubble hashtag or

27
00:00:59,209 --> 00:00:57,840
Hubble hang out hashtag hang it three

28
00:01:03,080 --> 00:00:59,219
times a week I'm going to get that right

29
00:01:04,759 --> 00:01:03,090
well handling as well as all you can

30
00:01:06,140 --> 00:01:04,769
also comment on YouTube and the Google+

31
00:01:09,200 --> 00:01:06,150
event page where this is being broadcast

32
00:01:10,640 --> 00:01:09,210
so we hope you'll do it please leave us

33
00:01:11,990 --> 00:01:10,650
questions and comments about anything

34
00:01:14,630 --> 00:01:12,000
related to Hubble and we'll try to get

35
00:01:18,170 --> 00:01:14,640
them as well so with me this week as I

36
00:01:20,090 --> 00:01:18,180
said before is dr. Laurent lemme from

37
00:01:23,810 --> 00:01:20,100
the University of Paris a mood on he

38
00:01:25,160 --> 00:01:23,820

studies Aurora's and he's with us today

39
00:01:27,649 --> 00:01:25,170
to give us he's been using the Hubble

40
00:01:29,690 --> 00:01:27,659
Space Telescope to look not at the ones

41
00:01:31,609 --> 00:01:29,700
within our own planet but ones within

42
00:01:34,280 --> 00:01:31,619
our solar system so welcome Laurent was

43
00:01:36,620 --> 00:01:34,290
looking forward to talking with you also

44
00:01:38,480 --> 00:01:36,630
with me as always are my very good

45
00:01:40,850 --> 00:01:38,490
friends dr. carol christian from the

46
00:01:43,910 --> 00:01:40,860
Space Telescope Science Institute she is

47
00:01:45,679 --> 00:01:43,920
a an astronomer here and wonderful

48
00:01:48,050 --> 00:01:45,689
wonderful insights and great great

49
00:01:49,910 --> 00:01:48,060
feedback from an information from Hubble

50
00:01:52,850 --> 00:01:49,920
as well as my good friend scott lewis

51
00:01:54,609 --> 00:01:52,860
from know the cosmos calm and he's here

52
00:01:58,069 --> 00:01:54,619
to also help out so welcome everybody

53
00:01:59,510 --> 00:01:58,079
let's get started first of all what's

54
00:02:05,600 --> 00:01:59,520
the appropriate what's the right way to

55
00:02:07,850 --> 00:02:05,610
say the plural of aurora oh okay since i

56
00:02:10,369 --> 00:02:07,860
seem to struggle with that was not

57
00:02:12,200 --> 00:02:10,379
planet or actually i'm personally using

58
00:02:15,080 --> 00:02:12,210
or all right

59
00:02:17,720 --> 00:02:15,090
is that Nigerian form and I think

60
00:02:20,510 --> 00:02:17,730
Aurora's is the u.s. translation of that

61
00:02:22,850 --> 00:02:20,520
but feel free to use the word you p sure

62
00:02:25,190 --> 00:02:22,860
they all sound wrong to me so whichever

63
00:02:28,370 --> 00:02:25,200

one so i prefer i'm gonna use Aurora's

64
00:02:31,310 --> 00:02:28,380
just because it sounds better i guess so

65
00:02:33,620 --> 00:02:31,320
although read what better in that case

66
00:02:35,390 --> 00:02:33,630
is to speak about oral emissions so that

67
00:02:37,580 --> 00:02:35,400
you call they're all these a curious

68
00:02:39,410 --> 00:02:37,590
emissions as a bench and you do not have

69
00:02:42,470 --> 00:02:39,420
to think about your own record to use

70
00:02:45,350 --> 00:02:42,480
there you go I like that all right well

71
00:02:46,730 --> 00:02:45,360
the good good advice okay so let's talk

72
00:02:49,880 --> 00:02:46,740
about so let's talk a little bit about

73
00:02:52,880 --> 00:02:49,890
the general topic of these rural

74
00:02:56,090 --> 00:02:52,890
emissions as you call them we see them

75
00:02:57,650 --> 00:02:56,100
here on earth they they as you are going

76
00:03:00,950 --> 00:02:57,660
to show us that we've seen them on other

77
00:03:02,960 --> 00:03:00,960
planets are they so what what can you

78
00:03:04,490 --> 00:03:02,970
give me the most general definition of

79
00:03:07,730 --> 00:03:04,500
what these things are what is this

80
00:03:10,160 --> 00:03:07,740
phenomenon that's that's a good way to

81
00:03:13,160 --> 00:03:10,170
begin with since people do not generally

82
00:03:16,160 --> 00:03:13,170
agree on how what to call or I these

83
00:03:19,520 --> 00:03:16,170
days but historically oral emissions

84
00:03:22,220 --> 00:03:19,530
refer to these in 10 slides that were

85
00:03:26,380 --> 00:03:22,230
seen on earth's atmosphere for decades

86
00:03:30,440 --> 00:03:26,390
in the visible light visible domain so

87
00:03:34,610 --> 00:03:30,450
this remains then as I mean these

88
00:03:39,200 --> 00:03:34,620

categories of luminous emissions from

89
00:03:41,780 --> 00:03:39,210
the atmosphere and then with the study

90
00:03:43,880 --> 00:03:41,790
of the other planets and and I mean the

91
00:03:46,370 --> 00:03:43,890
study of oral processes from space we

92
00:03:48,500 --> 00:03:46,380
discovered or I also about the

93
00:03:50,390 --> 00:03:48,510
atmosphere and so now we are more

94
00:03:52,940 --> 00:03:50,400
generally speaking about oral emissions

95
00:03:56,930 --> 00:03:52,950
which consists actually in a series of

96
00:03:59,300 --> 00:03:56,940
different emission processes so both in

97
00:04:01,970 --> 00:03:59,310
the atmosphere and above the atmosphere

98
00:04:05,060 --> 00:04:01,980
in the surrounding environment of the

99
00:04:08,290 --> 00:04:05,070
magnetized panics in the atmosphere and

100
00:04:10,520 --> 00:04:08,300
above the atmosphere so not cool so what

101
00:04:12,590 --> 00:04:10,530
but that doesn't let it I also don't get

102
00:04:14,660 --> 00:04:12,600
it what are they what is causing these

103
00:04:16,550 --> 00:04:14,670
emissions is it is it different

104
00:04:19,670 --> 00:04:16,560
depending on the planet is that why we

105
00:04:21,710 --> 00:04:19,680
can't get more specific than that or we

106
00:04:25,440 --> 00:04:21,720
could say that we have the same series

107
00:04:27,570 --> 00:04:25,450
of production processes which exist at

108
00:04:29,610 --> 00:04:27,580
all planets but the species which are

109
00:04:32,400 --> 00:04:29,620
excited the atmospheric species in

110
00:04:35,130 --> 00:04:32,410
particular may be different so for

111
00:04:37,830 --> 00:04:35,140
instance on earth the visible light we

112
00:04:40,950 --> 00:04:37,840
see in the sky come directly from the

113
00:04:43,320 --> 00:04:40,960

collision between charged particles

114
00:04:46,110 --> 00:04:43,330
which come from the neighborhood at the

115
00:04:48,390 --> 00:04:46,120
earth and which collide with the neutral

116
00:04:51,600 --> 00:04:48,400
atmosphere so the neutral atmosphere act

117
00:04:53,910 --> 00:04:51,610
as a screen where energetic particles

118
00:04:56,070 --> 00:04:53,920
fall down actually we say that they

119
00:04:59,220 --> 00:04:56,080
precipitate and they transfer energy

120
00:05:02,400 --> 00:04:59,230
which is then re-radiated by the

121
00:05:05,730 --> 00:05:02,410
atmosphere thus the right we see the

122
00:05:08,520 --> 00:05:05,740
wavelength domain they consist of depend

123
00:05:11,550 --> 00:05:08,530
on the atmospheric composition and at

124
00:05:14,880 --> 00:05:11,560
earth the most relative species are

125
00:05:16,590 --> 00:05:14,890
nitrogen and oxygen which are able to i

126
00:05:19,260 --> 00:05:16,600
did in the visible government

127
00:05:21,900 --> 00:05:19,270
essentially and so saying i have a

128
00:05:23,670 --> 00:05:21,910
question so do you need in on every

129
00:05:25,890 --> 00:05:23,680
planet in the solar system do you need a

130
00:05:27,990 --> 00:05:25,900
magnetic field to get those charged

131
00:05:32,370 --> 00:05:28,000
particles or can you have a Roura

132
00:05:35,970 --> 00:05:32,380
without magnetic fields so generally

133
00:05:39,330 --> 00:05:35,980
speaking oral processes are actually

134
00:05:43,020 --> 00:05:39,340
only seen on magnetized planets so to

135
00:05:46,710 --> 00:05:43,030
have to generate these particles which

136
00:05:51,810 --> 00:05:46,720
at the end will excite the atmosphere

137
00:05:54,480 --> 00:05:51,820
you need a magnetic field which then

138
00:05:57,720 --> 00:05:54,490

produces what we call a magnetosphere so

139
00:06:01,770 --> 00:05:57,730
I think Tony if Scott if you agree is

140
00:06:04,770 --> 00:06:01,780
true to show the first picture with

141
00:06:07,920 --> 00:06:04,780
magnetospheres can show graphics well

142
00:06:11,960 --> 00:06:07,930
you are schematics of the solar system

143
00:06:16,620 --> 00:06:11,970
with values magnetized planets and these

144
00:06:19,980 --> 00:06:16,630
its current has a cup now ah okay so so

145
00:06:22,700 --> 00:06:19,990
basically a magnetic field is creating

146
00:06:25,140 --> 00:06:22,710
in the neighborhood of the the planets

147
00:06:27,150 --> 00:06:25,150
cavity which we call a magnetosphere and

148
00:06:30,950 --> 00:06:27,160
this is this cavity which has the

149
00:06:33,900 --> 00:06:30,960
ability they are complex phenomena to

150
00:06:36,900 --> 00:06:33,910
accelerate charged particles with which

151
00:06:39,450 --> 00:06:36,910
then will be guided along magnetic field

152
00:06:41,219 --> 00:06:39,460
line down to the polar region

153
00:06:44,129 --> 00:06:41,229
they can collide with each other

154
00:06:45,749 --> 00:06:44,139
atmosphere so what we're sticking with

155
00:06:47,129 --> 00:06:45,759
earth just for a minute before we go off

156
00:06:49,439 --> 00:06:47,139
these other planets for a second we have

157
00:06:51,029 --> 00:06:49,449
obviously we have a magnetic field that

158
00:06:52,260 --> 00:06:51,039
the particles are coming from the Sun

159
00:06:54,360 --> 00:06:52,270
charged particles from the Sun

160
00:06:56,939 --> 00:06:54,370
presumably electrons from the solar wind

161
00:06:59,339 --> 00:06:56,949
coming in following the magnetic field

162
00:07:00,450 --> 00:06:59,349
down and as you say hit these neutral

163
00:07:03,510 --> 00:07:00,460

particles high in the atmosphere

164
00:07:05,370 --> 00:07:03,520
primarily nice oxygen since that's what

165
00:07:07,710 --> 00:07:05,380
the earth is made their sadness was

166
00:07:10,200 --> 00:07:07,720
primarily made up and they glow they

167
00:07:14,600 --> 00:07:10,210
emit this light which is generally on

168
00:07:19,469 --> 00:07:14,610
earth green right Bri Nick Gregory

169
00:07:23,189 --> 00:07:19,479
postural the reason for that is due to

170
00:07:25,370 --> 00:07:23,199
an account come come physics which which

171
00:07:29,159 --> 00:07:25,380
mean that when you have a molecule or

172
00:07:31,680 --> 00:07:29,169
not on its able to radiate in a specific

173
00:07:35,279 --> 00:07:31,690
series of transition which produce like

174
00:07:37,730 --> 00:07:35,289
to actually the Earth's oral emissions

175
00:07:41,309 --> 00:07:37,740
in the atmosphere are not simply green

176
00:07:42,779 --> 00:07:41,319
no red nor only purple I know that was

177
00:07:45,240 --> 00:07:42,789
an oversimplification but they're also

178
00:07:48,469 --> 00:07:45,250
agree okay they cover a wide spectrum

179
00:07:51,120 --> 00:07:48,479
with a few very intense line which give

180
00:07:54,240 --> 00:07:51,130
the impression that visa missions are

181
00:07:58,860 --> 00:07:54,250
very colored in a very very specific

182
00:08:03,029 --> 00:07:58,870
transitions okay so the other lovely

183
00:08:05,189 --> 00:08:03,039
also ahead we like just to come back on

184
00:08:07,980 --> 00:08:05,199
something that you say quickly actually

185
00:08:11,219 --> 00:08:07,990
the charged particles we are dealing

186
00:08:14,700 --> 00:08:11,229
with I'm not directly coming from the

187
00:08:17,240 --> 00:08:14,710
Sun or more specifically from the solar

188
00:08:19,499 --> 00:08:17,250

wind actually these cavity which is

189
00:08:22,680 --> 00:08:19,509
produced by magnetic field planetary

190
00:08:25,620 --> 00:08:22,690
magnetic field is at first order

191
00:08:28,950 --> 00:08:25,630
deviating the solar wing on the edges of

192
00:08:31,680 --> 00:08:28,960
that cavity so that at first order this

193
00:08:33,360 --> 00:08:31,690
is a plasma proof when I say the

194
00:08:35,490 --> 00:08:33,370
particles of the solar we cannot

195
00:08:37,649 --> 00:08:35,500
penetrate into the magnetosphere so

196
00:08:40,260 --> 00:08:37,659
those charged particles and there are

197
00:08:42,630 --> 00:08:40,270
some complex phenomena may be able to

198
00:08:45,600 --> 00:08:42,640
enter in somewhere because this is not

199
00:08:48,210 --> 00:08:45,610
always a plasma proof but these

200
00:08:51,030 --> 00:08:48,220
particles before to produce aura have to

201
00:08:52,519 --> 00:08:51,040
be sort of reprocessed by the

202
00:08:55,189 --> 00:08:52,529
magnetosphere which will

203
00:08:57,679 --> 00:08:55,199
accelerate them transfer energy to them

204
00:09:00,439 --> 00:08:57,689
before they will be able to to emit or

205
00:09:03,170 --> 00:09:00,449
us so the link between Salah mean and

206
00:09:05,989 --> 00:09:03,180
the lights we see the atmosphere is not

207
00:09:08,749 --> 00:09:05,999
direct I don't understand so you're

208
00:09:11,509 --> 00:09:08,759
telling me that that the the particles

209
00:09:12,829 --> 00:09:11,519
from the solar wind are following the

210
00:09:15,170 --> 00:09:12,839
field lines and if you look at what

211
00:09:17,509 --> 00:09:15,180
Scott has up those field lines are shown

212
00:09:20,179 --> 00:09:17,519
in those yellow lines there what we

213
00:09:22,280 --> 00:09:20,189

actually see emitted by the time we see

214
00:09:25,429 --> 00:09:22,290
the light is not due to the solar wind

215
00:09:27,410 --> 00:09:25,439
particles so and if you want to

216
00:09:29,600 --> 00:09:27,420
understand this simply we can just

217
00:09:32,569 --> 00:09:29,610
consider the fact that the charged

218
00:09:35,210 --> 00:09:32,579
particles which are carried by the solar

219
00:09:38,600 --> 00:09:35,220
wind are not energetic enough to produce

220
00:09:41,720 --> 00:09:38,610
or all emissions right this is the first

221
00:09:44,210 --> 00:09:41,730
point so we agreed we need something to

222
00:09:46,400 --> 00:09:44,220
twirl to transfer energy to these

223
00:09:47,929 --> 00:09:46,410
particles because they can be good

224
00:09:49,759 --> 00:09:47,939
candidates to produce these emissions

225
00:09:52,429 --> 00:09:49,769
this is the first point the second point

226
00:09:54,650 --> 00:09:52,439
is that at Earth oral emissions are

227
00:09:57,350 --> 00:09:54,660
mostly produced on the night side of the

228
00:09:59,420 --> 00:09:57,360
planet so the night side means that you

229
00:10:01,939 --> 00:09:59,430
are not facing the same so there cannot

230
00:10:04,100 --> 00:10:01,949
be a direct link between these particles

231
00:10:06,379 --> 00:10:04,110
which are coming from the Sun and the

232
00:10:08,869 --> 00:10:06,389
these powerful emission which are seen

233
00:10:11,689 --> 00:10:08,879
on the night side of the planet so I was

234
00:10:13,999 --> 00:10:11,699
simply saying that these particles which

235
00:10:17,329 --> 00:10:14,009
are arriving with which are transported

236
00:10:19,519 --> 00:10:17,339
by solar wind are not directly

237
00:10:21,740 --> 00:10:19,529
responsible for the emissions receive

238
00:10:23,530 --> 00:10:21,750

they need first to enter into the

239
00:10:26,420 --> 00:10:23,540
magnetosphere other of some complex

240
00:10:29,059 --> 00:10:26,430
conditions and then to be reprocessed to

241
00:10:31,879 --> 00:10:29,069
be warmed to be accelerated before they

242
00:10:34,160 --> 00:10:31,889
can then give rise to oral emissions on

243
00:10:35,720 --> 00:10:34,170
the night side of the planet got it okay

244
00:10:37,429 --> 00:10:35,730
so the key word where was it was

245
00:10:39,799 --> 00:10:37,439
accelerated it seems to me like you need

246
00:10:42,350 --> 00:10:39,809
to get these particles more energy than

247
00:10:45,559 --> 00:10:42,360
what they would have out in our if I get

248
00:10:47,119 --> 00:10:45,569
it now okay uh but I'm are you sure they

249
00:10:49,309 --> 00:10:47,129
don't happen during the day because and

250
00:10:52,009 --> 00:10:49,319
we just can't see them or they really

251
00:10:54,710 --> 00:10:52,019
don't happen during the day the

252
00:10:58,249 --> 00:10:54,720
situation is always a less simplistic

253
00:11:01,100 --> 00:10:58,259
than that we are explained so I was

254
00:11:02,900 --> 00:11:01,110
referring to intense alright which are

255
00:11:06,250 --> 00:11:02,910
seen on the night side of the earth of

256
00:11:09,050 --> 00:11:06,260
course they are all right all around

257
00:11:11,960 --> 00:11:09,060
both magnetic poles and so that's why we

258
00:11:15,290 --> 00:11:11,970
are speaking about Paula all right and

259
00:11:16,940 --> 00:11:15,300
not simply borealis or I borealis

260
00:11:19,190 --> 00:11:16,950
because bobble is just refers to the

261
00:11:21,470 --> 00:11:19,200
northern hemisphere and I also write in

262
00:11:24,260 --> 00:11:21,480
the south on a Miss fear sauce rice all

263
00:11:27,829 --> 00:11:24,270

right and so they're all right all

264
00:11:31,340 --> 00:11:27,839
around these are these magnetic poles

265
00:11:34,160 --> 00:11:31,350
forming what we call oral ovals but the

266
00:11:36,290 --> 00:11:34,170
oboes euro ovals themselves which are

267
00:11:38,780 --> 00:11:36,300
centered on magnetic poles are knowing

268
00:11:41,570 --> 00:11:38,790
terms of the night side so you are faint

269
00:11:43,730 --> 00:11:41,580
all right on the on the day side the

270
00:11:46,670 --> 00:11:43,740
issue is that as visitations are very

271
00:11:48,680 --> 00:11:46,680
faint we are generally not able to see

272
00:11:50,810 --> 00:11:48,690
them because the contrast is too faint

273
00:11:53,480 --> 00:11:50,820
on the on the day side to catch them in

274
00:11:54,410 --> 00:11:53,490
this guy okay Carol I think I cut you

275
00:11:57,500 --> 00:11:54,420
off when you're trying to say something

276
00:12:00,440 --> 00:11:57,510
did you want to put add to this no no no

277
00:12:02,690 --> 00:12:00,450
Lauren explained it that the the solar

278
00:12:04,970 --> 00:12:02,700
wind particles can then interact with

279
00:12:08,030 --> 00:12:04,980
stuff in the magnetosphere which then

280
00:12:10,160 --> 00:12:08,040
can cascade and and interact with the

281
00:12:14,300 --> 00:12:10,170
atmosphere so there can be a transition

282
00:12:16,610 --> 00:12:14,310
zone and acceleration was one of the

283
00:12:18,620 --> 00:12:16,620
keys is that they have to accelerate too

284
00:12:21,260 --> 00:12:18,630
and the magnetic field helps with that

285
00:12:22,970 --> 00:12:21,270
okay why I think I think we've

286
00:12:24,560 --> 00:12:22,980
established what these things are in a

287
00:12:27,530 --> 00:12:24,570
general sense Lauren let me ask you this

288
00:12:29,360 --> 00:12:27,540

now what is your what what got you into

289
00:12:32,120 --> 00:12:29,370
this what is your research interest in

290
00:12:35,990 --> 00:12:32,130
in studying these things on other

291
00:12:38,840 --> 00:12:36,000
planets what got you go in on this so my

292
00:12:40,910 --> 00:12:38,850
purpose of interest is to try to take

293
00:12:43,639 --> 00:12:40,920
advantage take benefit of these oil

294
00:12:45,980 --> 00:12:43,649
emissions which can be sensed remotely

295
00:12:49,760 --> 00:12:45,990
by your telescopes as adult for instance

296
00:12:51,769 --> 00:12:49,770
to diagnose to study planetary

297
00:12:54,620 --> 00:12:51,779
magnetospheres because generally

298
00:12:57,590 --> 00:12:54,630
speaking a magnetic field cannot be

299
00:13:00,230 --> 00:12:57,600
stood out over than Institute with

300
00:13:03,110 --> 00:13:00,240
special measurements that can be done

301
00:13:06,350 --> 00:13:03,120
with spacecraft exploring the various

302
00:13:07,850 --> 00:13:06,360
planets of the solar system but when we

303
00:13:10,010 --> 00:13:07,860
do not have the possibility to send

304
00:13:13,160 --> 00:13:10,020
spacecraft around magnetics planet and

305
00:13:15,890 --> 00:13:13,170
our all emissions remain useful and

306
00:13:19,130 --> 00:13:15,900
powerful tool to investigate remotely

307
00:13:20,000 --> 00:13:19,140
the physics of this magnetosphere so my

308
00:13:22,460 --> 00:13:20,010
purpose is

309
00:13:26,180 --> 00:13:22,470
try to take advantage of these emissions

310
00:13:29,330 --> 00:13:26,190
to take all the informations that they

311
00:13:33,130 --> 00:13:29,340
carry down and then to explain the

312
00:13:35,720 --> 00:13:33,140
physics of the magnetosphere liable to

313
00:13:37,160 --> 00:13:35,730

thank you and your primarily and you've

314
00:13:39,980 --> 00:13:37,170
been using the Hubble Space Telescope

315
00:13:43,340 --> 00:13:39,990
for a lot is correct yes that's correct

316
00:13:46,370 --> 00:13:43,350
because as for the outer planets so the

317
00:13:49,220 --> 00:13:46,380
planet beyond the orbit of the earth the

318
00:13:51,410 --> 00:13:49,230
composition of the atmosphere is as for

319
00:13:54,950 --> 00:13:51,420
the giant planets generally dominated by

320
00:13:56,420 --> 00:13:54,960
a hydrogenic species so the atmosphere

321
00:13:58,180 --> 00:13:56,430
compound atmospheric composition is

322
00:14:01,130 --> 00:13:58,190
different from that from the earth and

323
00:14:03,650 --> 00:14:01,140
this atmospheric composition as the

324
00:14:06,950 --> 00:14:03,660
ability at the capability to radiate in

325
00:14:10,970 --> 00:14:06,960
the UV window and that word is

326
00:14:13,700 --> 00:14:10,980
particularly able to look at so there is

327
00:14:17,600 --> 00:14:13,710
a very powerful tool to look at the aura

328
00:14:18,590 --> 00:14:17,610
of other planets that yet you know you

329
00:14:20,150 --> 00:14:18,600
know Carol one of the things I'm

330
00:14:23,360 --> 00:14:20,160
noticing in these hangouts lately is

331
00:14:26,360 --> 00:14:23,370
that awful lot of people are using the

332
00:14:27,740 --> 00:14:26,370
UV capabilities of Hubble we know last

333
00:14:28,700 --> 00:14:27,750
few hangouts we've had we've we talked

334
00:14:30,920 --> 00:14:28,710
about this that's been a really

335
00:14:32,630 --> 00:14:30,930
important part of people using the

336
00:14:33,890 --> 00:14:32,640
Hubble I guess I always looked at it as

337
00:14:35,330 --> 00:14:33,900
more of an infrared instrument but you

338
00:14:37,940 --> 00:14:35,340

know we have a lot of people using the

339
00:14:41,150 --> 00:14:37,950
UV as well so yeah and i think i think

340
00:14:42,500 --> 00:14:41,160
what started was of course because we

341
00:14:44,390 --> 00:14:42,510
have a lot of experience in ground-based

342
00:14:46,220 --> 00:14:44,400
astronomy we started with kind of the

343
00:14:47,960 --> 00:14:46,230
visual so we do a lot of the things that

344
00:14:50,720 --> 00:14:47,970
we know in the visual and then pushed

345
00:14:52,720 --> 00:14:50,730
into the infrared but the UV capability

346
00:14:56,120 --> 00:14:52,730
and the fact that we got new instruments

347
00:15:00,350 --> 00:14:56,130
that that assisted with that capability

348
00:15:04,010 --> 00:15:00,360
has really been powerful and when Hubble

349
00:15:06,680 --> 00:15:04,020
no longer is working we have no other UV

350
00:15:09,860 --> 00:15:06,690
capability in space and we can't get a

351
00:15:14,950 --> 00:15:09,870
UV on the ground so right now it is a

352
00:15:18,620 --> 00:15:14,960
young why is a source it's called money

353
00:15:22,160 --> 00:15:18,630
on the ground we can't to see the UV

354
00:15:26,000 --> 00:15:22,170
very far into the UV that's right I know

355
00:15:27,790 --> 00:15:26,010
I'm being facetious come on the ground

356
00:15:30,620 --> 00:15:27,800
we can't see because the atmosphere

357
00:15:33,140 --> 00:15:30,630
happily blocks it so that we're not all

358
00:15:33,710 --> 00:15:33,150
fried it's a good thing I'm going good

359
00:15:35,540 --> 00:15:33,720
thing

360
00:15:37,910 --> 00:15:35,550
the visual comes through a little bit of

361
00:15:40,100 --> 00:15:37,920
the infrared in certain places but the

362
00:15:43,639 --> 00:15:40,110
water vapor helps block the infrared and

363
00:15:45,949 --> 00:15:43,649

some of the radio as well so we need

364
00:15:49,129 --> 00:15:45,959
telescopes in space and Hubble right now

365
00:15:51,499 --> 00:15:49,139
is the one that has UV capability it may

366
00:15:54,949 --> 00:15:51,509
be that after 2020 there might be

367
00:15:57,829 --> 00:15:54,959
another telescope proposed to NASA that

368
00:15:59,749 --> 00:15:57,839
will have some UV capability but you're

369
00:16:02,920 --> 00:15:59,759
right the people are really looking to

370
00:16:05,449 --> 00:16:02,930
the UV to use Hubble in the UV um

371
00:16:07,340 --> 00:16:05,459
because you need to know a lot of these

372
00:16:09,110 --> 00:16:07,350
phenomenon that you can't see in the

373
00:16:11,300 --> 00:16:09,120
visible or the infrared so it is an

374
00:16:12,259 --> 00:16:11,310
important aspect yeah it's an important

375
00:16:13,490 --> 00:16:12,269
wavelength one that I'm just now

376
00:16:15,530 --> 00:16:13,500
starting to appreciate with Hubble

377
00:16:17,090 --> 00:16:15,540
because of the recent hangouts we've had

378
00:16:19,429 --> 00:16:17,100
not to mention this one and as well as

379
00:16:22,840 --> 00:16:19,439
the the ultra deep field with just added

380
00:16:27,050 --> 00:16:22,850
UV as well so okay so yeah i had sorry i

381
00:16:30,170 --> 00:16:27,060
had to i had two questions one is when

382
00:16:32,600 --> 00:16:30,180
did astronomers first realize that the

383
00:16:34,699 --> 00:16:32,610
other planets had is this one of these

384
00:16:37,519 --> 00:16:34,709
things we always knew but we didn't you

385
00:16:40,490 --> 00:16:37,529
know we didn't suspect it or we just

386
00:16:43,850 --> 00:16:40,500
didn't ever observe it or or when did

387
00:16:47,299 --> 00:16:43,860
the this interest in other planet Aurora

388
00:16:49,309 --> 00:16:47,309

start and the second question is do the

389
00:16:52,670 --> 00:16:49,319
colors on other planets tell you

390
00:16:57,619 --> 00:16:52,680
anything about the composition so I saw

391
00:16:59,749 --> 00:16:57,629
the first question we spoke since the

392
00:17:01,879 --> 00:16:59,759
beginning of that hang out about visible

393
00:17:04,399 --> 00:17:01,889
emission in the atmosphere starting with

394
00:17:06,289 --> 00:17:04,409
yes actually there are also our

395
00:17:08,000 --> 00:17:06,299
emissions which are produced above the

396
00:17:10,819 --> 00:17:08,010
atmosphere we quickly mention them at

397
00:17:13,970 --> 00:17:10,829
the beginning which are actually radio

398
00:17:16,279 --> 00:17:13,980
emission so atmospheric emissions are

399
00:17:18,439 --> 00:17:16,289
produced by we say the precipitating

400
00:17:20,779 --> 00:17:18,449
charged particles essentially electrons

401
00:17:22,370 --> 00:17:20,789
and these electrons when guided by

402
00:17:26,000 --> 00:17:22,380
magnetic field line down to the

403
00:17:28,039 --> 00:17:26,010
atmosphere have the possibility to do to

404
00:17:31,700 --> 00:17:28,049
drive residence and stability to produce

405
00:17:34,789 --> 00:17:31,710
radio waves so radio emissions are also

406
00:17:36,470 --> 00:17:34,799
of oral nature and they are found around

407
00:17:38,690 --> 00:17:36,480
all magnetized planets of the solar

408
00:17:42,350 --> 00:17:38,700
system so back to your question the

409
00:17:45,049 --> 00:17:42,360
first time we found or on another planet

410
00:17:47,210 --> 00:17:45,059
than Earth well thanks to radio

411
00:17:50,860 --> 00:17:47,220
observations from the ground we've read

412
00:17:53,600 --> 00:17:50,870
telescopes based in the US and

413
00:17:55,430 --> 00:17:53,610

discovering the data the chemistry

414
00:17:57,409 --> 00:17:55,440
condition of Jupiter and actually which

415
00:17:59,960 --> 00:17:57,419
was the first proof that Jupiter

416
00:18:04,520 --> 00:17:59,970
processes a magnetic an internal

417
00:18:06,830 --> 00:18:04,530
magnetic shield and then with the space

418
00:18:09,770 --> 00:18:06,840
exploration thanks to the Voyager

419
00:18:13,340 --> 00:18:09,780
spacecraft which explored the four giant

420
00:18:16,730 --> 00:18:13,350
planets in the night in the 80s mainly

421
00:18:19,940 --> 00:18:16,740
70s 80s we had the possibility to look

422
00:18:22,279 --> 00:18:19,950
Institute with small telescopes on board

423
00:18:24,500 --> 00:18:22,289
the Voyager spacecraft and in particular

424
00:18:27,710 --> 00:18:24,510
UV spectrometer which was able to

425
00:18:30,380 --> 00:18:27,720
identify overall emissions at all these

426
00:18:33,500 --> 00:18:30,390
planets or Jupiter satyam in order

427
00:18:35,090 --> 00:18:33,510
Uranus and Neptune all around before you

428
00:18:37,159 --> 00:18:35,100
go any further I 20 up real quick say

429
00:18:38,990 --> 00:18:37,169
Scott's got a pretty picture up so that

430
00:18:42,789 --> 00:18:39,000
we can emphasize that what are we

431
00:18:46,310 --> 00:18:42,799
looking at here so this picture is a

432
00:18:49,279 --> 00:18:46,320
sort of a collage of UV observations

433
00:18:52,549 --> 00:18:49,289
acquired by the open space telescope for

434
00:18:55,810 --> 00:18:52,559
the three giant system which are those

435
00:18:58,610 --> 00:18:55,820
of Jupiter Saturn and Uranus and showing

436
00:19:01,730 --> 00:18:58,620
basically the emissions which can be

437
00:19:04,840 --> 00:19:01,740
seen in the UV window so on these on

438
00:19:07,279 --> 00:19:04,850

these figures you show the planets and

439
00:19:12,830 --> 00:19:07,289
sometimes the satellite that have been

440
00:19:15,289 --> 00:19:12,840
caught by the HST em as well and you see

441
00:19:18,799 --> 00:19:15,299
that there are different sort of

442
00:19:20,840 --> 00:19:18,809
emissions the solar light is reflected

443
00:19:23,600 --> 00:19:20,850
generally by the atmosphere of these

444
00:19:27,440 --> 00:19:23,610
bodies so this is why the planet or

445
00:19:30,950 --> 00:19:27,450
satellites are bluish all over the

446
00:19:33,470 --> 00:19:30,960
surface and in addition to this you see

447
00:19:35,060 --> 00:19:33,480
bright emissions which are the aura we

448
00:19:37,730 --> 00:19:35,070
are speaking as since the beginning of

449
00:19:39,560 --> 00:19:37,740
this stock which are these powerful

450
00:19:42,380 --> 00:19:39,570
emission you see the rear white and

451
00:19:44,510 --> 00:19:42,390
which are very localized so we say at

452
00:19:47,240 --> 00:19:44,520
earth that these emissions are

453
00:19:50,720 --> 00:19:47,250
distributed along two main so-called

454
00:19:52,850 --> 00:19:50,730
oral ovals so say two circles centered

455
00:19:55,070 --> 00:19:52,860
around magnetic poles and you can see

456
00:19:56,960 --> 00:19:55,080
here that looking at the specific

457
00:20:00,049 --> 00:19:56,970
planets for instance Jupiter the

458
00:20:01,100 --> 00:20:00,059
situation is both similar you see an

459
00:20:03,230 --> 00:20:01,110
oval which is

460
00:20:05,720 --> 00:20:03,240
crescenta out on the sofa magnetic board

461
00:20:07,730 --> 00:20:05,730
here but also different the the

462
00:20:10,310 --> 00:20:07,740
phenology is much more complex and

463
00:20:12,580 --> 00:20:10,320

valuable than at F and this can be

464
00:20:14,960 --> 00:20:12,590
transposed to the other planets as well

465
00:20:17,930 --> 00:20:14,970
so noticing with this image here that I

466
00:20:20,200 --> 00:20:17,940
owe seems to have Aurora as well roll

467
00:20:25,100 --> 00:20:20,210
emissions is that what I'm seeing there

468
00:20:29,090 --> 00:20:25,110
in this image which one I owe the moon

469
00:20:31,789 --> 00:20:29,100
what is yes so I you is an example of

470
00:20:35,650 --> 00:20:31,799
aura that week which can be found on a

471
00:20:38,630 --> 00:20:35,660
satellite because we briefly say that

472
00:20:41,030 --> 00:20:38,640
such lights are produced when there is a

473
00:20:43,820 --> 00:20:41,040
beam of energetic particles which

474
00:20:47,380 --> 00:20:43,830
collide with a neutral medium say an

475
00:20:53,419 --> 00:20:47,390
atmosphere and so as these satellites

476
00:20:55,039 --> 00:20:53,429
say I Organa need or Europa possesses an

477
00:20:58,400 --> 00:20:55,049
exhaust fee or at least the surface

478
00:21:01,159 --> 00:20:58,410
where this can particle can with which

479
00:21:07,250 --> 00:21:01,169
this kind particle can collide these

480
00:21:09,250 --> 00:21:07,260
witnesses derive the arrival of beams of

481
00:21:13,970 --> 00:21:09,260
charged particles so these materialize

482
00:21:15,980 --> 00:21:13,980
arise arise of satellites hmm and so and

483
00:21:18,049 --> 00:21:15,990
tighten there right next to it looks

484
00:21:21,680 --> 00:21:18,059
pretty quiet be does that mean not so

485
00:21:24,169 --> 00:21:21,690
much or what what is that Titan was put

486
00:21:25,909 --> 00:21:24,179
there because it was observed but nor or

487
00:21:29,180 --> 00:21:25,919
other missions where we are detected on

488
00:21:33,799 --> 00:21:29,190

that satellite because it's not very

489
00:21:37,250 --> 00:21:33,809
well coupled in the electrodynamic term

490
00:21:39,110 --> 00:21:37,260
to his planet contrary to iOS Jupiter

491
00:21:42,830 --> 00:21:39,120
and just to come back to the second

492
00:21:44,840 --> 00:21:42,840
question of Kerala what may we infer

493
00:21:47,299 --> 00:21:44,850
we've is emissions about the atmospheric

494
00:21:49,789 --> 00:21:47,309
compositions atmospheric composition of

495
00:21:53,120 --> 00:21:49,799
his bodies as for the atmosphere of

496
00:21:55,010 --> 00:21:53,130
giant planets Jupiter Saturn Uranus we

497
00:21:57,289 --> 00:21:55,020
know that the atmosphere is dominated by

498
00:21:59,180 --> 00:21:57,299
hydrogen XP sees so this has been shown

499
00:22:02,720 --> 00:21:59,190
with a spectroscopic observations of

500
00:22:06,909 --> 00:22:02,730
other in particular that we are facing

501
00:22:10,280 --> 00:22:06,919
emissions oral emissions are reflecting

502
00:22:12,470 --> 00:22:10,290
H&H too many species so this is a

503
00:22:14,690 --> 00:22:12,480
diagnosis of the atmospheric composition

504
00:22:17,500 --> 00:22:14,700
as far i owe the situation

505
00:22:22,460 --> 00:22:17,510
quite differently Scott because I o is a

506
00:22:25,100 --> 00:22:22,470
emitting is possessing Nexus sphere

507
00:22:27,230 --> 00:22:25,110
which is made of different atmospheric

508
00:22:30,740 --> 00:22:27,240
species exhaust Eric species and may be

509
00:22:32,540 --> 00:22:30,750
dominated by oxygen so on the image of

510
00:22:38,870 --> 00:22:32,550
are you what you see the aura that you

511
00:22:42,170 --> 00:22:38,880
see are produced by oxygen so the UV

512
00:22:44,690 --> 00:22:42,180
window is able to do to pick up specific

513
00:22:47,240 --> 00:22:44,700

transitions which which can come from

514
00:22:50,720 --> 00:22:47,250
either hydrogen for the atmosphere giant

515
00:22:53,360 --> 00:22:50,730
planets either oxygen or the dioxygen

516
00:22:55,900 --> 00:22:53,370
for for their satellites so we all know

517
00:22:58,070 --> 00:22:55,910
that I was a pretty active place

518
00:22:59,690 --> 00:22:58,080
geologically and with you know lots of

519
00:23:00,890 --> 00:22:59,700
activity going on there and the reason

520
00:23:03,410 --> 00:23:00,900
that you're confident these are our

521
00:23:04,940 --> 00:23:03,420
rural emissions happens to be the fact

522
00:23:06,620 --> 00:23:04,950
that they're so bright in the UV then

523
00:23:09,050 --> 00:23:06,630
correct and not something else that

524
00:23:11,270 --> 00:23:09,060
might be going on with or without yes

525
00:23:13,910 --> 00:23:11,280
they are bright they are localized they

526
00:23:16,880 --> 00:23:13,920
are transient so these are properties of

527
00:23:19,790 --> 00:23:16,890
early missions this cannot be something

528
00:23:22,280 --> 00:23:19,800
due to the the reflected sunlight for

529
00:23:26,470 --> 00:23:22,290
instance because it would affect the

530
00:23:28,730 --> 00:23:26,480
world enlighted face on the satellite

531
00:23:30,230 --> 00:23:28,740
okay I have a really relate a really

532
00:23:33,230 --> 00:23:30,240
good related question from Patrick

533
00:23:35,000 --> 00:23:33,240
Calhoun on the Q&A app who is going do

534
00:23:37,700 --> 00:23:35,010
you think a planetary filter will ever

535
00:23:41,570 --> 00:23:37,710
be made some day for us to see the

536
00:23:43,940 --> 00:23:41,580
Aurora from Earth a planet that we

537
00:23:46,250 --> 00:23:43,950
feature yeah I guess I guess the

538
00:23:49,040 --> 00:23:46,260

question is should we see would we be

539
00:23:54,620 --> 00:23:49,050
able to observe planetary Aurora from

540
00:23:57,410 --> 00:23:54,630
Hubble of the earth I think this has

541
00:24:01,100 --> 00:23:57,420
been done not by over vetted by an over

542
00:24:02,450 --> 00:24:01,110
x-ray telescope orbiting Earth pointing

543
00:24:05,720 --> 00:24:02,460
to the night side of the earth and

544
00:24:08,270 --> 00:24:05,730
tracking x-ray mission but I don't think

545
00:24:11,240 --> 00:24:08,280
about try to do that because of the risk

546
00:24:13,280 --> 00:24:11,250
to to point the Sun in the field of view

547
00:24:15,920 --> 00:24:13,290
and then to to damage the instruments

548
00:24:18,320 --> 00:24:15,930
but carol you may correct me now that's

549
00:24:20,840 --> 00:24:18,330
right we can't point at the earth and in

550
00:24:23,510 --> 00:24:20,850
fact when Hubble goes or as the Hubble

551
00:24:25,550 --> 00:24:23,520
goes around the earth we have to make

552
00:24:27,680 --> 00:24:25,560
sure we're not pointing towards it

553
00:24:28,159 --> 00:24:27,690
because it's too bright and so we can't

554
00:24:32,450 --> 00:24:28,169
make

555
00:24:34,700 --> 00:24:32,460
observations of the earth I think there

556
00:24:38,419 --> 00:24:34,710
are also there may have been some earth

557
00:24:40,930 --> 00:24:38,429
looking you know like Landsat and GOI

558
00:24:45,129 --> 00:24:40,940
and some of those earth looking

559
00:24:48,289 --> 00:24:45,139
satellites certainly the astronauts saw

560
00:24:51,739 --> 00:24:48,299
Aurora for all the fish with a shovel

561
00:24:53,899 --> 00:24:51,749
Knight they took lots of pictures so

562
00:24:58,039 --> 00:24:53,909
that's a better platform that's a great

563
00:24:59,960 --> 00:24:58,049

platform initially but is really the

564
00:25:02,570 --> 00:24:59,970
sensitivity and the size of the

565
00:25:06,200 --> 00:25:02,580
telescope the primary mirror that the

566
00:25:08,419 --> 00:25:06,210
stsci team does not want to damage and

567
00:25:12,200 --> 00:25:08,429
you write that many spacecraft I've

568
00:25:15,259 --> 00:25:12,210
taken images of the observer from space

569
00:25:17,599 --> 00:25:15,269
and so imaging both arise on the day

570
00:25:21,109 --> 00:25:17,609
side and on the night side and you also

571
00:25:24,460 --> 00:25:21,119
write by pointing that the ISS team the

572
00:25:26,599 --> 00:25:24,470
astronauts onboard the ISS station are

573
00:25:28,999 --> 00:25:26,609
continuously taking photographs and

574
00:25:32,239 --> 00:25:29,009
making beautiful films that you may find

575
00:25:34,489 --> 00:25:32,249
on the internet and that show actually

576
00:25:37,430 --> 00:25:34,499
very well the dynamics of this emission

577
00:25:40,519 --> 00:25:37,440
when we are on the on the earth we can

578
00:25:42,889 --> 00:25:40,529
look at these emissions from very far

579
00:25:44,810 --> 00:25:42,899
actually and that's the same situation

580
00:25:46,729 --> 00:25:44,820
for a telescope which is orbiting the

581
00:25:49,460 --> 00:25:46,739
Earth very far but with the ISS station

582
00:25:51,879 --> 00:25:49,470
the auras are seen by the age actually

583
00:25:55,460 --> 00:25:51,889
so the level of detail is really

584
00:25:57,950 --> 00:25:55,470
impressive yeah good question and the

585
00:26:01,070 --> 00:25:57,960
well I got page 2 for those that want to

586
00:26:03,049 --> 00:26:01,080
see the Aurora from space it's for the

587
00:26:05,749 --> 00:26:03,059
Gateway astronaut photography of Earth

588
00:26:07,849 --> 00:26:05,759

and swear i use when I've made some of

589
00:26:10,009 --> 00:26:07,859
my compilation videos I use a lot of the

590
00:26:11,659 --> 00:26:10,019
source material here which are from the

591
00:26:13,070 --> 00:26:11,669
time-lapse photography that are done by

592
00:26:16,269 --> 00:26:13,080
the astronauts from the International

593
00:26:18,470 --> 00:26:16,279
Space Station I'll put it into the

594
00:26:20,269 --> 00:26:18,480
Google+ event I'll tweet it out there

595
00:26:22,220 --> 00:26:20,279
but for those and actually i'll put in a

596
00:26:26,029 --> 00:26:22,230
comment on youtube too but it's e 0 l

597
00:26:27,769 --> 00:26:26,039
dot JSC nasa gov and you're you're able

598
00:26:29,960 --> 00:26:27,779
to go through and actually get all the

599
00:26:32,419 --> 00:26:29,970
full resolution images if you want them

600
00:26:35,029 --> 00:26:32,429
or also see them in a movie file yeah

601
00:26:36,769 --> 00:26:35,039
the time racks the ISS is far are we one

602
00:26:38,659 --> 00:26:36,779
of the best spots to try and see some of

603
00:26:39,940 --> 00:26:38,669
these activities so that's that's good

604
00:26:42,100 --> 00:26:39,950
thanks God

605
00:26:44,200 --> 00:26:42,110
ok so we've we've basic what I want to

606
00:26:47,190 --> 00:26:44,210
know though Laurent is okay so you've

607
00:26:49,419 --> 00:26:47,200
been looking at these observe these uh

608
00:26:51,220 --> 00:26:49,429
Rory from all different planets and

609
00:26:53,769 --> 00:26:51,230
using the Hubble you've gotten gotten

610
00:26:55,600 --> 00:26:53,779
some good data what have been the

611
00:26:58,060 --> 00:26:55,610
greatest what's been your biggest

612
00:26:59,950 --> 00:26:58,070
surprise in observing has there been a

613
00:27:01,870 --> 00:26:59,960

planet that was unusually more active

614
00:27:03,340 --> 00:27:01,880
than you thought brighter than you

615
00:27:06,029 --> 00:27:03,350
thought they have is anything really

616
00:27:08,590 --> 00:27:06,039
really surprised you in your research

617
00:27:10,450 --> 00:27:08,600
you mean myself for the community in

618
00:27:12,639 --> 00:27:10,460
general what way out amazing I guess

619
00:27:14,799 --> 00:27:12,649
both I guess both so I mean I like

620
00:27:16,299 --> 00:27:14,809
looking at these Rory what were you what

621
00:27:19,210 --> 00:27:16,309
were you expecting versus what did you

622
00:27:22,690 --> 00:27:19,220
find if we take the case of Jupiter for

623
00:27:25,629 --> 00:27:22,700
instance so Scott maybe you may may

624
00:27:28,990 --> 00:27:25,639
display the composite figure of Jupiter

625
00:27:31,120 --> 00:27:29,000
made made of other images taken in the

626
00:27:37,389 --> 00:27:31,130
UV and in the visible range you see

627
00:27:40,799 --> 00:27:37,399
these two ovals centered around magnetic

628
00:27:43,840 --> 00:27:40,809
poles right shut up now okay and when

629
00:27:48,009 --> 00:27:43,850
yet UV observers look at these images

630
00:27:50,649 --> 00:27:48,019
first they identified that stranger spot

631
00:27:52,990 --> 00:27:50,659
that you see both the novel in the

632
00:27:54,610 --> 00:27:53,000
southern hemisphere do seat it's a quite

633
00:27:58,000 --> 00:27:54,620
a world of the main oval its a bright

634
00:27:59,620 --> 00:27:58,010
spot with sort of the wake right is not

635
00:28:02,470 --> 00:27:59,630
bright right below the spirits on both

636
00:28:04,659 --> 00:28:02,480
sides a number oh yes that's on both on

637
00:28:07,690 --> 00:28:04,669
both on both sides and actually people

638
00:28:10,210 --> 00:28:07,700

then realize that this was this spot was

639
00:28:12,750 --> 00:28:10,220
related to the magnetic flux tube which

640
00:28:16,120 --> 00:28:12,760
was connecting to the satellite I oh and

641
00:28:19,930 --> 00:28:16,130
so that was a surprise let me say that

642
00:28:21,460 --> 00:28:19,940
again make sure hahaha so this magnetic

643
00:28:23,139 --> 00:28:21,470
flux tube the mat you said was the

644
00:28:26,289 --> 00:28:23,149
magnetic flux tube associated with I oh

645
00:28:28,360 --> 00:28:26,299
right exactly and so there are over

646
00:28:31,629 --> 00:28:28,370
sports which may be seen on the

647
00:28:34,600 --> 00:28:31,639
following picture if Scott can display

648
00:28:39,039 --> 00:28:34,610
it which are associated with over

649
00:28:41,230 --> 00:28:39,049
Galilean satellites a Jupiter so the

650
00:28:43,629 --> 00:28:41,240
fact that we get a spot at the footprint

651
00:28:45,430 --> 00:28:43,639
so we call it a footprint of a magnetic

652
00:28:48,039 --> 00:28:45,440
field connected to a satellite is

653
00:28:51,009 --> 00:28:48,049
sending us something and the most

654
00:28:53,019 --> 00:28:51,019
enthusiastic discovery was to realize

655
00:28:53,620 --> 00:28:53,029
that there was sort of a coupling

656
00:28:56,140 --> 00:28:53,630
between

657
00:28:58,800 --> 00:28:56,150
satellite and the planets able to

658
00:29:02,200 --> 00:28:58,810
accelerate particle enough to produce

659
00:29:05,020 --> 00:29:02,210
such bright footprints at the foot of

660
00:29:07,060 --> 00:29:05,030
the field lines connecting satellite to

661
00:29:09,220 --> 00:29:07,070
the planets so this was a major

662
00:29:12,370 --> 00:29:09,230
discovery actually and when you look at

663
00:29:15,010 --> 00:29:12,380

at at least picture of Jupiter with the

664
00:29:16,900 --> 00:29:15,020
main oval and some specific polarization

665
00:29:18,820 --> 00:29:16,910
you clearly see different spots which

666
00:29:20,580 --> 00:29:18,830
are materially materializing the

667
00:29:23,590 --> 00:29:20,590
different Galilean satellites of Jupiter

668
00:29:26,260 --> 00:29:23,600
I'm in which is beside the scar and

669
00:29:28,650 --> 00:29:26,270
having a pregnant I'm trying to yes I

670
00:29:31,840 --> 00:29:28,660
see it it says the main oval and it has

671
00:29:35,350 --> 00:29:31,850
yeah Scott has it up and it shows IO and

672
00:29:37,780 --> 00:29:35,360
Europa and Ganymede and since there are

673
00:29:41,320 --> 00:29:37,790
little dots that that then connect the

674
00:29:42,910 --> 00:29:41,330
two the tube line so so I mean what

675
00:29:45,640 --> 00:29:42,920
Laura is saying if i can put words in

676
00:29:49,900 --> 00:29:45,650
his mouth is that jupiter is an amazing

677
00:29:52,090 --> 00:29:49,910
environment because the you know some of

678
00:29:54,820 --> 00:29:52,100
those satellites those moons have

679
00:29:57,520 --> 00:29:54,830
atmospheres as well and and Jupiter

680
00:30:02,620 --> 00:29:57,530
really interacts with some of the main

681
00:30:04,810 --> 00:30:02,630
moons it's mains moons and so there's

682
00:30:07,900 --> 00:30:04,820
this communication that goes on between

683
00:30:10,900 --> 00:30:07,910
Jupiter and the moon's through these

684
00:30:16,420 --> 00:30:10,910
magnetic field lines and so they share

685
00:30:19,420 --> 00:30:16,430
this Aurora phenomenon exactly I'm sorry

686
00:30:22,510 --> 00:30:19,430
go ahead finish exactly and this

687
00:30:24,700 --> 00:30:22,520
connection is of electric nature because

688
00:30:27,970 --> 00:30:24,710

we have an exchange of charged particles

689
00:30:29,530 --> 00:30:27,980
so this means currents and just to

690
00:30:32,770 --> 00:30:29,540
finish with if we take that picture of

691
00:30:34,960 --> 00:30:32,780
Jupiter if we now exclude a satellite

692
00:30:36,940 --> 00:30:34,970
you see that you also add a manual mode

693
00:30:38,920 --> 00:30:36,950
gather with polar missions and all

694
00:30:42,610 --> 00:30:38,930
together we can say that when we look at

695
00:30:46,780 --> 00:30:42,620
the specific at orals emissions of a

696
00:30:50,460 --> 00:30:46,790
specific planet each part of this

697
00:30:53,590 --> 00:30:50,470
complex morphology says something to us

698
00:30:56,140 --> 00:30:53,600
in terms of magnetospheric physics I

699
00:30:57,940 --> 00:30:56,150
mean to produce this bright emission you

700
00:31:00,190 --> 00:30:57,950
need to have an active region somewhere

701
00:31:02,950 --> 00:31:00,200
in the magnetosphere and each bright

702
00:31:05,980 --> 00:31:02,960
spot our overalls or transient phenomena

703
00:31:07,350 --> 00:31:05,990
refer to something a commune transiently

704
00:31:11,890 --> 00:31:07,360
or not in the magnetosphere

705
00:31:15,100 --> 00:31:11,900
is there any relationship or connection

706
00:31:17,290 --> 00:31:15,110
between the size of the planet and the

707
00:31:19,410 --> 00:31:17,300
strength of these Aurora like does

708
00:31:22,990 --> 00:31:19,420
Jupiter have more powerful more bright

709
00:31:26,010 --> 00:31:23,000
Aurora them then other smaller planets

710
00:31:29,620 --> 00:31:26,020
or is that a is that related in any way

711
00:31:32,560 --> 00:31:29,630
yes Jupiter is the most powerful or a

712
00:31:34,000 --> 00:31:32,570
limiter of the solar system these

713
00:31:36,940 --> 00:31:34,010

emissions that we see in these pictures

714
00:31:38,920 --> 00:31:36,950
are generally two to three orders of

715
00:31:41,560 --> 00:31:38,930
magnitude more intense in terms of

716
00:31:44,920 --> 00:31:41,570
emitted power with respect to these of

717
00:31:47,290 --> 00:31:44,930
the earth for instance Saturn is only

718
00:31:50,230 --> 00:31:47,300
one order of magnitude brighter with

719
00:31:51,760 --> 00:31:50,240
respect to the earth but then what is

720
00:31:55,780 --> 00:31:51,770
the reason what is the reason for his

721
00:31:58,360 --> 00:31:55,790
brightness you will ask right yes one

722
00:32:02,860 --> 00:31:58,370
guy yeah that was going to go okay and

723
00:32:04,450 --> 00:32:02,870
and we store under current understanding

724
00:32:06,760 --> 00:32:04,460
they are two main gentleman on that

725
00:32:09,190 --> 00:32:06,770
trigger the strength of this oral

726
00:32:11,260 --> 00:32:09,200
phenomena the first is the interaction

727
00:32:12,700 --> 00:32:11,270
with the solar wind the interaction

728
00:32:17,110 --> 00:32:12,710
between solar wind and the Earth's

729
00:32:21,250 --> 00:32:17,120
magnetic field is the primary generator

730
00:32:24,490 --> 00:32:21,260
for Earth's aura and Jupiter is the over

731
00:32:26,200 --> 00:32:24,500
external case as Jupiter is not very

732
00:32:28,690 --> 00:32:26,210
sensitive disallowing at all it

733
00:32:30,400 --> 00:32:28,700
possesses very strong magnetic field so

734
00:32:32,530 --> 00:32:30,410
is not very sensitive to Salah win and

735
00:32:34,660 --> 00:32:32,540
these bright emissions essentially

736
00:32:37,960 --> 00:32:34,670
internally triggered by the rapid

737
00:32:40,180 --> 00:32:37,970
rotation of the planet so the solar wind

738
00:32:42,870 --> 00:32:40,190

affect and effect at the planning degree

739
00:32:44,680 --> 00:32:42,880
rotation are the two main drivers for

740
00:32:46,870 --> 00:32:44,690
responsible for the brightness of

741
00:32:48,970 --> 00:32:46,880
reservations so if you had a small

742
00:32:50,920 --> 00:32:48,980
planet that rotated very fast and had a

743
00:32:53,170 --> 00:32:50,930
very bright or very strong magnetic

744
00:32:55,900 --> 00:32:53,180
field for whatever reason you would get

745
00:32:57,960 --> 00:32:55,910
equally bright or at least very bright a

746
00:33:01,420 --> 00:32:57,970
role emissions from that so exactly

747
00:33:04,120 --> 00:33:01,430
exactly and we can we can quote the case

748
00:33:06,520 --> 00:33:04,130
of mercury which which has very weak

749
00:33:08,920 --> 00:33:06,530
magnetic field but which is located very

750
00:33:11,560 --> 00:33:08,930
close to the Sun and so where are the

751
00:33:14,260 --> 00:33:11,570
solar wind acts as the primary driver

752
00:33:17,680 --> 00:33:14,270
for oral emissions and as mercury is

753
00:33:19,930 --> 00:33:17,690
even weekly magnetized it displays all

754
00:33:21,399 --> 00:33:19,940
as well oh I didn't know that Wow well

755
00:33:24,519 --> 00:33:21,409
what about okay so let's talk about that

756
00:33:26,200 --> 00:33:24,529
Mars for example has as far as I know no

757
00:33:30,610 --> 00:33:26,210
magnetic field correct it doesn't have

758
00:33:33,399 --> 00:33:30,620
much of a dynamo at all uh so nothing

759
00:33:35,740 --> 00:33:33,409
right from Mars it would well as the

760
00:33:37,960 --> 00:33:35,750
question is open masters processor what

761
00:33:40,840 --> 00:33:37,970
we see what we call a crystal magnetic

762
00:33:43,590 --> 00:33:40,850
show so this is not Pamela a one

763
00:33:46,330 --> 00:33:43,600

magnetic field crystal I need to fill

764
00:33:48,639 --> 00:33:46,340
crystal which means that tourism right

765
00:33:51,100 --> 00:33:48,649
you make sure I understood because oh ok

766
00:33:53,049 --> 00:33:51,110
Chris right that's where certainly used

767
00:33:55,570 --> 00:33:53,059
in the past to possessed a permanent

768
00:33:57,970 --> 00:33:55,580
magnetic film like those of the other

769
00:34:02,320 --> 00:33:57,980
planets but it disappeared and we only

770
00:34:04,720 --> 00:34:02,330
have traces of of it now which easier to

771
00:34:08,680 --> 00:34:04,730
call the crystal magnetic field and in

772
00:34:10,720 --> 00:34:08,690
the neighborhood of these traces of past

773
00:34:14,950 --> 00:34:10,730
magnetic field there have been some

774
00:34:17,440 --> 00:34:14,960
attempts to detect our emissions this is

775
00:34:19,990 --> 00:34:17,450
not abuse at all and then to finish with

776
00:34:22,750 --> 00:34:20,000
Venus Venus does not process any

777
00:34:24,790 --> 00:34:22,760
magnetic field at all so Venus this net

778
00:34:30,430 --> 00:34:24,800
force it process any permanent

779
00:34:31,569 --> 00:34:30,440
magnetosphere no all emissions I'm still

780
00:34:33,700 --> 00:34:31,579
trying to get my head around the church

781
00:34:37,139 --> 00:34:33,710
for magnetic field but i bet there is

782
00:34:39,129 --> 00:34:37,149
something there that's causing some some

783
00:34:40,780 --> 00:34:39,139
interaction in some way i should point

784
00:34:43,210 --> 00:34:40,790
out that you have two small children in

785
00:34:46,750 --> 00:34:43,220
the background who are those just me oh

786
00:34:50,470 --> 00:34:46,760
that's hot yeah it's sorry the other

787
00:34:53,470 --> 00:34:50,480
picking me today absol yes god this is a

788
00:34:56,760 --> 00:34:53,480

great night Lake Forest yeah oh yeah

789
00:35:00,370 --> 00:34:56,770
it's true it is exact well okay so what

790
00:35:04,510 --> 00:35:00,380
the so youyou've you found that these

791
00:35:06,099 --> 00:35:04,520
are blue these satellite interactions

792
00:35:08,200 --> 00:35:06,109
were surprises or something you didn't

793
00:35:10,000 --> 00:35:08,210
expect to see when you began your

794
00:35:11,380 --> 00:35:10,010
research is there what's the future

795
00:35:14,160 --> 00:35:11,390
where are you going to head for here

796
00:35:17,050 --> 00:35:14,170
what's what's in store for you next so

797
00:35:19,420 --> 00:35:17,060
these satellites were an example of what

798
00:35:23,050 --> 00:35:19,430
surprised not only me but the community

799
00:35:25,599 --> 00:35:23,060
when most recently I've worked with

800
00:35:27,670 --> 00:35:25,609
adult Frank stable on the Uranus

801
00:35:29,130 --> 00:35:27,680
magnetosphere which was very intriguing

802
00:35:31,559 --> 00:35:29,140
because

803
00:35:34,769 --> 00:35:31,569
Uranus oral oral emissions and

804
00:35:37,529 --> 00:35:34,779
magnetosphere could only be investigated

805
00:35:41,039 --> 00:35:37,539
once during the flyby of the planet by

806
00:35:43,079 --> 00:35:41,049
the voyager 2 spacecraft in 1986 so we

807
00:35:45,329 --> 00:35:43,089
could study that magnetosphere and all

808
00:35:47,970 --> 00:35:45,339
our processes only with a few hours of

809
00:35:50,789 --> 00:35:47,980
measurements acquired by Voyager 2 along

810
00:35:53,940 --> 00:35:50,799
its trajectory but then we knew that

811
00:35:56,870 --> 00:35:53,950
Uranus was magnetized and display or all

812
00:35:58,680 --> 00:35:56,880
emissions and by calculating the

813
00:36:01,339 --> 00:35:58,690

theoretical brightness of these

814
00:36:04,380 --> 00:36:01,349
emissions we found that it shall be a

815
00:36:06,690 --> 00:36:04,390
chore feet the minimum threshold

816
00:36:10,620 --> 00:36:06,700
detection threshold of HST so we

817
00:36:14,849 --> 00:36:10,630
recently try to catch visa mission again

818
00:36:18,150 --> 00:36:14,859
and to do that instead of so this had

819
00:36:20,339 --> 00:36:18,160
been done twice in two decades as for

820
00:36:22,589 --> 00:36:20,349
Uranus but always with negative

821
00:36:24,359 --> 00:36:22,599
detections and instead of observing

822
00:36:26,039 --> 00:36:24,369
randomly this time we try to take

823
00:36:28,380 --> 00:36:26,049
benefit of a property we just mentioned

824
00:36:31,910 --> 00:36:28,390
which is the interaction between solar

825
00:36:34,079 --> 00:36:31,920
wind and the magnetic field of a planet

826
00:36:37,740 --> 00:36:34,089
because we mentioned this very briefly

827
00:36:42,059 --> 00:36:37,750
but one property of the earth satin and

828
00:36:43,859 --> 00:36:42,069
so the extra extrapolating this to

829
00:36:46,890 --> 00:36:43,869
Uranus and Neptune one property of this

830
00:36:49,769 --> 00:36:46,900
magnetosphere is to react to a strong

831
00:36:52,230 --> 00:36:49,779
compression of the solar wind reaching

832
00:36:56,490 --> 00:36:52,240
this planet so idea this is called as

833
00:36:58,730 --> 00:36:56,500
the substorm phenomena and with which

834
00:37:01,799 --> 00:36:58,740
gave rise to the state's waiver

835
00:37:03,509 --> 00:37:01,809
discipline when the compression rather

836
00:37:06,029 --> 00:37:03,519
earth the magnetosphere is compressed

837
00:37:08,130 --> 00:37:06,039
and then there is some of acceleration

838
00:37:11,490 --> 00:37:08,140

processes that are forced because of

839
00:37:16,109 --> 00:37:11,500
that compressed magnetosphere and this

840
00:37:20,599 --> 00:37:16,119
gives rise to very bright auras right

841
00:37:23,579 --> 00:37:20,609
and so to try to catch uranus or as we

842
00:37:28,109 --> 00:37:23,589
made the assumption that you're honest

843
00:37:30,109 --> 00:37:28,119
may react as as the earth does and so we

844
00:37:32,640 --> 00:37:30,119
observed during the path of a series of

845
00:37:35,190 --> 00:37:32,650
coronal mass ejection which we are

846
00:37:37,740 --> 00:37:35,200
propagating in the outer i use view

847
00:37:40,529 --> 00:37:37,750
along the along the planets until

848
00:37:42,609 --> 00:37:40,539
reaching uranus and then thanks to Adele

849
00:37:44,470 --> 00:37:42,619
we could observe at the right

850
00:37:50,170 --> 00:37:44,480
place at the right time and we got a

851
00:37:53,109 --> 00:37:50,180
detection and a picture of which I Scott

852
00:37:55,150 --> 00:37:53,119
may be able to show you right Harriet

853
00:37:56,650 --> 00:37:55,160
I'm really glad you talked about this

854
00:37:59,289 --> 00:37:56,660
because I was going to ask about this a

855
00:38:01,089 --> 00:37:59,299
bit of that cascading through the solar

856
00:38:02,710 --> 00:38:01,099
system and you being able to watch you

857
00:38:04,960 --> 00:38:02,720
know the mass ejection then comes to

858
00:38:07,779 --> 00:38:04,970
earth and etc so that's very interesting

859
00:38:12,190 --> 00:38:07,789
that you can kind of watch it propagate

860
00:38:14,019 --> 00:38:12,200
and then find really faint signature yes

861
00:38:16,870 --> 00:38:14,029
your friend and as far as I'm concerned

862
00:38:19,960 --> 00:38:16,880
that was one of the most surprising

863
00:38:23,230 --> 00:38:19,970

results we gotta thanks to movies novels

864
00:38:24,759 --> 00:38:23,240
measurements so coronal mass ejections

865
00:38:26,799 --> 00:38:24,769
are these magnetic eruptions from the

866
00:38:28,839 --> 00:38:26,809
Sun there they can be enormous and they

867
00:38:33,099 --> 00:38:28,849
they go out throughout the solar system

868
00:38:35,680 --> 00:38:33,109
with a lot of very primarily electrons

869
00:38:37,299 --> 00:38:35,690
and and things going along with it and

870
00:38:39,519 --> 00:38:37,309
when they hit these planets then it

871
00:38:40,630 --> 00:38:39,529
looks like you can see the signatures be

872
00:38:42,519 --> 00:38:40,640
able to compress you said the

873
00:38:45,970 --> 00:38:42,529
compression of the atmosphere and these

874
00:38:48,729 --> 00:38:45,980
are rural emissions net can we talk

875
00:38:50,440 --> 00:38:48,739
about Neptune for a minute I if I I may

876
00:38:52,329 --> 00:38:50,450
be screwing this up but i remember i

877
00:38:55,479 --> 00:38:52,339
think when Voyager 2 and by they were

878
00:38:57,579 --> 00:38:55,489
seeing these white bands on Neptune am I

879
00:38:59,620 --> 00:38:57,589
remembering correctly and they were

880
00:39:01,269 --> 00:38:59,630
these it was in the upper atmosphere of

881
00:39:05,349 --> 00:39:01,279
Neptune and I was wondering if those

882
00:39:08,529 --> 00:39:05,359
were a rural emissions or not well Jeff

883
00:39:11,289 --> 00:39:08,539
lie by nature to fly by Neptune in 1989

884
00:39:13,180 --> 00:39:11,299
and as for the other planets it's UV

885
00:39:14,710 --> 00:39:13,190
spectrometer looked carefully at the

886
00:39:17,829 --> 00:39:14,720
other atmosphere of the planet and

887
00:39:20,289 --> 00:39:17,839
actually tentatively detected aura but

888
00:39:22,380 --> 00:39:20,299

they are they very faint and close to

889
00:39:25,720 --> 00:39:22,390
the detection threshold so even these

890
00:39:27,999 --> 00:39:25,730
claim that detection is not confirmed

891
00:39:29,950 --> 00:39:28,009
yet so I'm correct with what we did for

892
00:39:32,259 --> 00:39:29,960
your armies could certainly be reapplied

893
00:39:34,089 --> 00:39:32,269
for me Neptune except that an

894
00:39:38,019 --> 00:39:34,099
opportunist thieves much farther from

895
00:39:40,359 --> 00:39:38,029
the Sun and supposedly displays fainter

896
00:39:43,329 --> 00:39:40,369
all right so we are really at the limit

897
00:39:44,650 --> 00:39:43,339
of what other can do with the oral

898
00:39:46,960 --> 00:39:44,660
emissions of the planets of the solar

899
00:39:48,339 --> 00:39:46,970
system okay Charles Bell has got a

900
00:39:49,809 --> 00:39:48,349
couple of really good questions for us

901
00:39:52,599 --> 00:39:49,819
on the queue and I am let me start with

902
00:39:54,690 --> 00:39:52,609
his first one he's asking have you

903
00:39:57,270 --> 00:39:54,700
studied the hydrogen

904
00:40:01,050 --> 00:39:57,280
via lyman-alpha emission from Venus

905
00:40:05,849 --> 00:40:01,060
using the Soho Swan images so host 1 i'm

906
00:40:12,089 --> 00:40:05,859
not sure what that is no i didn't and so

907
00:40:15,990 --> 00:40:12,099
what visa and how is named the charles

908
00:40:19,490 --> 00:40:16,000
though what's up what child is referring

909
00:40:22,829 --> 00:40:19,500
to is the fact that when venus is

910
00:40:25,710 --> 00:40:22,839
swamped into the solar wind it possesses

911
00:40:29,190 --> 00:40:25,720
a induced magnetosphere because the

912
00:40:31,980 --> 00:40:29,200
plasma are not pass through the planet

913
00:40:33,270 --> 00:40:31,990

and so it passes on the edges and it

914
00:40:36,240 --> 00:40:33,280
creates what we call it induced

915
00:40:38,099 --> 00:40:36,250
magnetosphere all come up and these

916
00:40:39,900 --> 00:40:38,109
types of magnetosphere has completely

917
00:40:42,180 --> 00:40:39,910
different properties as the permanent

918
00:40:44,030 --> 00:40:42,190
magnetosphere we just discussed and in

919
00:40:46,950 --> 00:40:44,040
particular it does not display any

920
00:40:49,829 --> 00:40:46,960
powerful plasma acceleration process

921
00:40:51,540 --> 00:40:49,839
which could trigger or other missions so

922
00:40:54,780 --> 00:40:51,550
i have not stood I'd Venus at all I

923
00:40:57,870 --> 00:40:54,790
would like two parts in some some

924
00:40:59,579 --> 00:40:57,880
occasion but because Venus is not a

925
00:41:02,730 --> 00:40:59,589
primary candidate for displaying these

926
00:41:05,280 --> 00:41:02,740
emissions okay good question Charles

927
00:41:07,079 --> 00:41:05,290
thank you uh Soho Swan I'm trying to

928
00:41:09,690 --> 00:41:07,089
think I thought I knew Soho I don't

929
00:41:12,180 --> 00:41:09,700
recall up I just went on there called

930
00:41:13,079 --> 00:41:12,190
that but he's got one more question let

931
00:41:15,059 --> 00:41:13,089
me just go ahead and get this out

932
00:41:18,599 --> 00:41:15,069
because this is also related have you

933
00:41:20,550 --> 00:41:18,609
used NASA Swift ultraviolet optical

934
00:41:24,510 --> 00:41:20,560
telescope for planetary aurori this is

935
00:41:27,780 --> 00:41:24,520
also from Charles so Swift is a plane

936
00:41:31,140 --> 00:41:27,790
right I'm not sure maybe calorie may

937
00:41:34,050 --> 00:41:31,150
help me I think that's this refers to a

938
00:41:39,359 --> 00:41:34,060

plane which possesses a telescope and

939
00:41:41,460 --> 00:41:39,369
able to observe at the highest altitudes

940
00:41:44,099 --> 00:41:41,470
of the Earth's atmosphere this is some

941
00:41:48,540 --> 00:41:44,109
mixed mode question because Swift is an

942
00:41:52,710 --> 00:41:48,550
x-ray burster yeah a lie so I'm sure

943
00:41:57,480 --> 00:41:52,720
about a UV optical telescope above the

944
00:41:58,859 --> 00:41:57,490
atmosphere or other than Hubble so I'm

945
00:42:03,359 --> 00:41:58,869
not sure what we're referring to but

946
00:42:05,069 --> 00:42:03,369
Swift looks in the x-ray okay all right

947
00:42:07,200 --> 00:42:05,079
so I guess it doesn't sound like you've

948
00:42:08,400 --> 00:42:07,210
used it for that so I've question to

949
00:42:10,740 --> 00:42:08,410
thank you Charles

950
00:42:12,300 --> 00:42:10,750
um one more from Adam synergy who's got

951
00:42:14,970 --> 00:42:12,310
out who's got a good question he is he's

952
00:42:16,800 --> 00:42:14,980
also asking from the Q&A app he this is

953
00:42:19,470 --> 00:42:16,810
Adam asking would we see these bright

954
00:42:22,380 --> 00:42:19,480
emissions in a planet containing only

955
00:42:25,560 --> 00:42:22,390
layers of metallic hydrogen and helium

956
00:42:34,020 --> 00:42:25,570
or is there is this more evidence of an

957
00:42:35,700 --> 00:42:34,030
iron core inside Jupiter well so I to

958
00:42:37,620 --> 00:42:35,710
answer repeat the question please could

959
00:42:39,810 --> 00:42:37,630
you really the bushes bright emissions

960
00:42:42,150 --> 00:42:39,820
in a planet containing only layers of

961
00:42:43,740 --> 00:42:42,160
metallic hydrogen and helium or is this

962
00:42:47,400 --> 00:42:43,750
more evidence of an iron core inside

963
00:42:49,290 --> 00:42:47,410

Jupiter but the fact is that these

964
00:42:51,270 --> 00:42:49,300
emissions are produced at the uppermost

965
00:42:54,570 --> 00:42:51,280
of the atmosphere and this does not

966
00:42:56,400 --> 00:42:54,580
consist of metallic hydrogen Metallica

967
00:42:59,310 --> 00:42:56,410
children is rather found at the core of

968
00:43:01,560 --> 00:42:59,320
the planet so this is a different layer

969
00:43:03,660 --> 00:43:01,570
of the planetary which cannot be

970
00:43:06,240 --> 00:43:03,670
impacted by these particles which are

971
00:43:10,320 --> 00:43:06,250
stopped by pressure much as much higher

972
00:43:13,560 --> 00:43:10,330
altitudes disinfectants yes right and so

973
00:43:15,380 --> 00:43:13,570
and so so let me comment is that the

974
00:43:17,880 --> 00:43:15,390
aurora phenomena the fact that it is

975
00:43:20,040 --> 00:43:17,890
related to the magnetic field one can

976
00:43:22,140 --> 00:43:20,050
look at each planet and say what is it

977
00:43:25,320 --> 00:43:22,150
that generates the magnetic field in the

978
00:43:29,160 --> 00:43:25,330
poor of that object and in the case the

979
00:43:30,720 --> 00:43:29,170
earth it is partly an iron core in the

980
00:43:33,330 --> 00:43:30,730
other planets especially the outer

981
00:43:37,170 --> 00:43:33,340
planets were so largely gaseous it may

982
00:43:39,900 --> 00:43:37,180
be a different phenomenon so on the

983
00:43:42,120 --> 00:43:39,910
magnetic field itself although Laurent

984
00:43:43,860 --> 00:43:42,130
can correct me because I'm not an expert

985
00:43:45,900 --> 00:43:43,870
but I think the existence of the

986
00:43:48,900 --> 00:43:45,910
magnetic field just says that there is

987
00:43:52,820 --> 00:43:48,910
something causing the matok field in the

988
00:43:56,730 --> 00:43:52,830

in the core it may not necessarily be

989
00:43:58,050 --> 00:43:56,740
iron you know ferrous or anything it's

990
00:44:01,860 --> 00:43:58,060
just something that is capable of

991
00:44:04,800 --> 00:44:01,870
generating a magnetic field haha go

992
00:44:08,220 --> 00:44:04,810
ahead Laurent sorry no just just to

993
00:44:11,820 --> 00:44:08,230
briefly mention that we think because we

994
00:44:14,340 --> 00:44:11,830
aren't sure we never we're able to go

995
00:44:16,830 --> 00:44:14,350
into the deep core of a planet but

996
00:44:19,230 --> 00:44:16,840
wishing that planetary magnetic fields

997
00:44:21,520 --> 00:44:19,240
are produced by a dynamo effect which is

998
00:44:25,000 --> 00:44:21,530
driven by the motion of the

999
00:44:31,360 --> 00:44:25,010
some dense plasma so either a metallic

1000
00:44:34,560 --> 00:44:31,370
hydrogen or or or deeper of hours later

1001
00:44:38,740 --> 00:44:34,570
ions for instance in mercury which are

1002
00:44:40,600 --> 00:44:38,750
having some convection motion driven by

1003
00:44:46,000 --> 00:44:40,610
the rotation of the planet which then

1004
00:44:48,310 --> 00:44:46,010
give rise to a magnetic field ok so a

1005
00:44:50,620 --> 00:44:48,320
couple things here real quick to the

1006
00:44:53,790 --> 00:44:50,630
Swan instrument on soho is the solar

1007
00:44:55,810 --> 00:44:53,800
wind and invite pro-peace so that is a

1008
00:44:58,150 --> 00:44:55,820
collaboration with the finished

1009
00:45:00,640 --> 00:44:58,160
meteorological institute so that is an

1010
00:45:03,760 --> 00:45:00,650
instrument that's on soho and i have a

1011
00:45:07,540 --> 00:45:03,770
question from Twitter from summer ash

1012
00:45:10,210 --> 00:45:07,550
was wondering with the interactions with

1013
00:45:12,640 --> 00:45:10,220

the natural satellites of jupiter on the

1014
00:45:14,410 --> 00:45:12,650
aurora is our moon interacting it all

1015
00:45:18,760 --> 00:45:14,420
with our Aurora that we're seeing on

1016
00:45:22,690 --> 00:45:18,770
earth so actually no our moon is not

1017
00:45:25,000 --> 00:45:22,700
interacting at all I mean electrodynamic

1018
00:45:28,240 --> 00:45:25,010
Ali speaking with the earth because the

1019
00:45:30,610 --> 00:45:28,250
the condition for satellite interact

1020
00:45:34,060 --> 00:45:30,620
with the planet is first that the

1021
00:45:37,240 --> 00:45:34,070
satellite moves into the magnetosphere

1022
00:45:41,260 --> 00:45:37,250
so it says permanently magnetic field

1023
00:45:43,150 --> 00:45:41,270
passing in front of it and second the

1024
00:45:45,280 --> 00:45:43,160
satellite shell process a conductive

1025
00:45:48,400 --> 00:45:45,290
exhaust years which is the condition for

1026
00:45:50,920 --> 00:45:48,410
this gigantic electrical currents to

1027
00:45:53,350 --> 00:45:50,930
close actually along the field lines and

1028
00:45:55,780 --> 00:45:53,360
then at the satellite so without a

1029
00:46:00,040 --> 00:45:55,790
conductive exhaust fear this electric

1030
00:46:03,340 --> 00:46:00,050
interruption cannot cannot give rise so

1031
00:46:06,670 --> 00:46:03,350
unfortunately a year the moon does not

1032
00:46:09,700 --> 00:46:06,680
process kuni lexus fear and actually

1033
00:46:12,300 --> 00:46:09,710
passes half of its time and out of the

1034
00:46:16,140 --> 00:46:12,310
magnetosphere so that an iu jupiter

1035
00:46:18,250 --> 00:46:16,150
interaction cannot be helped yourself

1036
00:46:19,900 --> 00:46:18,260
that's a great question thank you for

1037
00:46:21,760 --> 00:46:19,910
that charles also wants to point out

1038
00:46:24,700 --> 00:46:21,770

Charles Bell points out that the Swift

1039
00:46:29,500 --> 00:46:24,710
has both x-ray and UV optical telescopes

1040
00:46:31,450 --> 00:46:29,510
on board and apparently as you so i

1041
00:46:33,760 --> 00:46:31,460
don't i don't think they're being used

1042
00:46:34,660 --> 00:46:33,770
right now and in the way that orientis

1043
00:46:40,320 --> 00:46:34,670
is

1044
00:46:43,950 --> 00:46:40,330
that Charles we appreciate it okay so

1045
00:46:47,350 --> 00:46:43,960
what is primarily to look at at galactic

1046
00:46:53,170 --> 00:46:47,360
burst worse things they don't in general

1047
00:46:58,330 --> 00:46:53,180
look at the solar system and in the case

1048
00:47:01,360 --> 00:46:58,340
of Soho Soho is specifically to look at

1049
00:47:03,790 --> 00:47:01,370
the Sun so it can tell you when there's

1050
00:47:05,050 --> 00:47:03,800
a burst or you know an emission from the

1051
00:47:07,660 --> 00:47:05,060
Sun but it's not going to turn around

1052
00:47:12,820 --> 00:47:07,670
and look at Jupiter in a response to

1053
00:47:14,260 --> 00:47:12,830
that right so one more go ahead you want

1054
00:47:15,790 --> 00:47:14,270
to say something to that yeah I just

1055
00:47:17,350 --> 00:47:15,800
wanted to add that I retrieve the name

1056
00:47:19,630 --> 00:47:17,360
of the plane I was thinking to buy

1057
00:47:21,700 --> 00:47:19,640
you're discussing a swift which is

1058
00:47:27,070 --> 00:47:21,710
called a so she actually so she is a

1059
00:47:29,380 --> 00:47:27,080
parigi I Yes Man suit us plane Weaver

1060
00:47:31,360 --> 00:47:29,390
some telescopes on board which are able

1061
00:47:33,880 --> 00:47:31,370
to observe at very high altitudes and

1062
00:47:36,010 --> 00:47:33,890
which process is a UV telescope but it

1063
00:47:38,830 --> 00:47:36,020

is to a dick in the atmosphere to be

1064
00:47:42,820 --> 00:47:38,840
able to observe either F so where are

1065
00:47:44,520 --> 00:47:42,830
all the other planets here's this one

1066
00:47:49,060 --> 00:47:44,530
also from the Q&A app from Elodie

1067
00:47:51,010 --> 00:47:49,070
arguello and I think I'm gonna I hope I

1068
00:47:54,940 --> 00:47:51,020
get this right is it unusual to have

1069
00:47:57,580 --> 00:47:54,950
Aurora's in the Sun and if not what

1070
00:47:59,950 --> 00:47:57,590
would be the consequences so i think i'm

1071
00:48:04,240 --> 00:47:59,960
reading that right can you have aurora

1072
00:48:06,550 --> 00:48:04,250
in the solar corona to gets nothing but

1073
00:48:09,040 --> 00:48:06,560
a charged particle but bath isn't it i

1074
00:48:12,130 --> 00:48:09,050
mean there's nothing but a plasma out

1075
00:48:13,930 --> 00:48:12,140
there certainly not the Aurora's that we

1076
00:48:15,940 --> 00:48:13,940
are used to see at the atmosphere

1077
00:48:18,820 --> 00:48:15,950
because the medium is not the same the

1078
00:48:20,680 --> 00:48:18,830
solar corona is very hot very charged

1079
00:48:22,750 --> 00:48:20,690
and this is completely different from

1080
00:48:25,590 --> 00:48:22,760
the neutral atmosphere we were dealing

1081
00:48:28,180 --> 00:48:25,600
with but so if we leave optical

1082
00:48:31,960 --> 00:48:28,190
emissions i think there are some

1083
00:48:34,300 --> 00:48:31,970
possibilities for the Sun to drive radio

1084
00:48:39,160 --> 00:48:34,310
emissions because radio emissions only

1085
00:48:41,560 --> 00:48:39,170
need tenuous plasma with energetic

1086
00:48:44,860 --> 00:48:41,570
electrons gyrating around magnetic field

1087
00:48:47,140 --> 00:48:44,870
lines so this can this can arrive around

1088
00:48:48,250 --> 00:48:47,150

magnetize planets but with may arrive as

1089
00:48:54,240 --> 00:48:48,260
well around the

1090
00:48:57,100 --> 00:48:54,250
and yeah so good the big the quran word

1091
00:49:01,810 --> 00:48:57,110
sorry i missed you the sound was good oh

1092
00:49:03,460 --> 00:49:01,820
you're dropping out I am oh so the the

1093
00:49:06,160 --> 00:49:03,470
environment of the solar corona is a

1094
00:49:08,260 --> 00:49:06,170
much different environment than the than

1095
00:49:10,360 --> 00:49:08,270
the than what we're talking about here

1096
00:49:13,210 --> 00:49:10,370
planetary atmospheres one when I was

1097
00:49:14,740 --> 00:49:13,220
working for one of the senior scientists

1098
00:49:16,480 --> 00:49:14,750
would ask love to ask the question how

1099
00:49:19,300 --> 00:49:16,490
can we have the Sun which is 5500

1100
00:49:22,330 --> 00:49:19,310
degrees Kelvin why could how can we have

1101
00:49:24,340 --> 00:49:22,340
a two million degree Kelvin two million

1102
00:49:26,110 --> 00:49:24,350
degree corona he used to love anti

1103
00:49:27,370 --> 00:49:26,120
question and and it's the answer is

1104
00:49:29,590 --> 00:49:27,380
rather intriguing I mean it's just a

1105
00:49:31,870 --> 00:49:29,600
very thin very dense a very thin

1106
00:49:34,510 --> 00:49:31,880
atmosphere however it's very very hot

1107
00:49:37,000 --> 00:49:34,520
and it's really a unique environment up

1108
00:49:38,530 --> 00:49:37,010
up in some but I don't think when you

1109
00:49:39,880 --> 00:49:38,540
think of the atmosphere of a son you

1110
00:49:41,440 --> 00:49:39,890
think of it as the same way as you would

1111
00:49:44,140 --> 00:49:41,450
have planet so but that is a good

1112
00:49:45,880 --> 00:49:44,150
question though thank you very much okay

1113
00:49:50,160 --> 00:49:45,890

Carol let's get to one here that's been

1114
00:49:52,300 --> 00:49:50,170
sitting here this is from Christian

1115
00:49:55,570 --> 00:49:52,310
timati i think i'm pronouncing it right

1116
00:49:58,120 --> 00:49:55,580
what is the expected life of the Hubble

1117
00:50:02,380 --> 00:49:58,130
Space Telescope well it's a good

1118
00:50:05,290 --> 00:50:02,390
question so right now everything on

1119
00:50:07,000 --> 00:50:05,300
Hubble is operational everything that

1120
00:50:09,330 --> 00:50:07,010
was operational in the last servicing

1121
00:50:12,010 --> 00:50:09,340
mission in 2009 is in operation today

1122
00:50:13,600 --> 00:50:12,020
there is part one part of the advanced

1123
00:50:15,280 --> 00:50:13,610
camera for surveys which hasn't worked

1124
00:50:16,900 --> 00:50:15,290
and was unable to be fixed but

1125
00:50:19,000 --> 00:50:16,910
everything else is working fine and that

1126
00:50:22,270 --> 00:50:19,010
includes not only instrumentation but

1127
00:50:24,370 --> 00:50:22,280
the batteries the computers the solar

1128
00:50:26,230 --> 00:50:24,380
cells and there are redundant systems as

1129
00:50:28,660 --> 00:50:26,240
well the pointing systems are redundant

1130
00:50:31,060 --> 00:50:28,670
so a few of the gyros have had some

1131
00:50:33,310 --> 00:50:31,070
difficulty and engineers watch the

1132
00:50:36,550 --> 00:50:33,320
performance of all of these instruments

1133
00:50:38,620 --> 00:50:36,560
as well as all of the satellite

1134
00:50:41,170 --> 00:50:38,630
components and as far as we can tell

1135
00:50:43,810 --> 00:50:41,180
except for a couple of the gyros that

1136
00:50:45,970 --> 00:50:43,820
have exhibited some noise and one

1137
00:50:48,340 --> 00:50:45,980
failure everything is operate as

1138
00:50:52,960 --> 00:50:48,350

operating fine so as long as it operates

1139
00:50:56,050 --> 00:50:52,970
fine it can last a long time and in

1140
00:50:58,690 --> 00:50:56,060
particular we are looking for now we're

1141
00:51:02,339 --> 00:50:58,700
on our 25th anniversary year we just

1142
00:51:06,400 --> 00:51:02,349
celebrated the 24th

1143
00:51:07,720 --> 00:51:06,410
we believe we astronomers believe and

1144
00:51:09,579 --> 00:51:07,730
some of the engineers believe it's going

1145
00:51:11,680 --> 00:51:09,589
to last until 2020 but it could last

1146
00:51:13,570 --> 00:51:11,690
well beyond that and the reason that

1147
00:51:15,640 --> 00:51:13,580
we're interested in having it last at

1148
00:51:17,770 --> 00:51:15,650
least until 2020 is because we would

1149
00:51:22,300 --> 00:51:17,780
like two years there's overlap with the

1150
00:51:26,500 --> 00:51:22,310
James Webb telescope which is launches

1151
00:51:28,990 --> 00:51:26,510
in 2018 but you know it's constantly

1152
00:51:31,240 --> 00:51:29,000
being monitored and it looks healthy so

1153
00:51:33,790 --> 00:51:31,250
it's like any other system you monitor

1154
00:51:36,609 --> 00:51:33,800
your car every day and you do the

1155
00:51:39,820 --> 00:51:36,619
readings and oil analysis and just check

1156
00:51:41,770 --> 00:51:39,830
your tire pressure and thanks Tim you

1157
00:51:43,390 --> 00:51:41,780
can be running we can't maintain it

1158
00:51:46,180 --> 00:51:43,400
anymore but it's going to run and run

1159
00:51:49,750 --> 00:51:46,190
and run until some major component fails

1160
00:51:52,329 --> 00:51:49,760
yeah if everything goes really well as

1161
00:51:54,280 --> 00:51:52,339
karolus is outlining all the stuff keeps

1162
00:51:57,730 --> 00:51:54,290
working then the limiting factor becomes

1163
00:51:59,800 --> 00:51:57,740

the orbit it's in and I think if i'm not

1164
00:52:03,310 --> 00:51:59,810
mistaken carol that is decide that will

1165
00:52:05,349 --> 00:52:03,320
be decided sometime around 20 28 it'll

1166
00:52:07,210 --> 00:52:05,359
start to have problems with its orbit

1167
00:52:11,530 --> 00:52:07,220
and we may have to take correct snack

1168
00:52:13,480 --> 00:52:11,540
corrective action by then somehow so so

1169
00:52:18,280 --> 00:52:13,490
that's the ultimate the ultimate day

1170
00:52:22,359 --> 00:52:18,290
would be 2028 sometime even if it's all

1171
00:52:25,030 --> 00:52:22,369
working perfectly so but so if I mean

1172
00:52:27,130 --> 00:52:25,040
this telescope has exceeded expectations

1173
00:52:28,900 --> 00:52:27,140
at every turn from the very beginning on

1174
00:52:31,630 --> 00:52:28,910
up and I want to point out while we're

1175
00:52:33,520 --> 00:52:31,640
on this topic that Carolyn and Scott and

1176
00:52:34,900 --> 00:52:33,530
I are planning a history of Hubble hang

1177
00:52:36,310 --> 00:52:34,910
out sometime in September where we're

1178
00:52:38,740 --> 00:52:36,320
going to talk about Hubble nothing but

1179
00:52:40,870 --> 00:52:38,750
about what it's done just what it's been

1180
00:52:42,339 --> 00:52:40,880
through how we fixed it what it's what

1181
00:52:45,700 --> 00:52:42,349
it's gone through so look for that also

1182
00:52:47,890 --> 00:52:45,710
in September I'm going to comment that

1183
00:52:49,839 --> 00:52:47,900
it's interesting because a lifetime of

1184
00:52:52,540 --> 00:52:49,849
Hubble is a little bit linked to what

1185
00:52:55,150 --> 00:52:52,550
Laura is talking about because with the

1186
00:52:58,420 --> 00:52:55,160
emissions from the Sun that can puff up

1187
00:53:01,540 --> 00:52:58,430
the atmosphere of the earth as well as

1188
00:53:05,079 --> 00:53:01,550

produce Aurora and depending on how the

1189
00:53:09,040 --> 00:53:05,089
atmosphere inflates or doesn't inflate

1190
00:53:11,230 --> 00:53:09,050
can produce drag if it puffs up enough

1191
00:53:14,920 --> 00:53:11,240
it produces drag on the telescope which

1192
00:53:18,190 --> 00:53:14,930
can then cause the orbit two

1193
00:53:21,190 --> 00:53:18,200
ok so the 20 28 I think is a

1194
00:53:23,559 --> 00:53:21,200
conservative estimate of the the

1195
00:53:26,410 --> 00:53:23,569
extension of the atmosphere and how much

1196
00:53:28,059 --> 00:53:26,420
it will influence the orbit of Hubble a

1197
00:53:29,260 --> 00:53:28,069
excellent point I mean it doesn't it

1198
00:53:30,730 --> 00:53:29,270
doesn't take into account all the

1199
00:53:32,530 --> 00:53:30,740
variations it can happen with space

1200
00:53:33,970 --> 00:53:32,540
weather and things like that people

1201
00:53:35,290 --> 00:53:33,980
forget that Hubble is while it is in

1202
00:53:36,940 --> 00:53:35,300
orbit it's still kind of in the

1203
00:53:38,770 --> 00:53:36,950
atmosphere of the earth so it is

1204
00:53:41,140 --> 00:53:38,780
affected by that a little bit and

1205
00:53:43,359 --> 00:53:41,150
Jacques darim on that also answers your

1206
00:53:44,650 --> 00:53:43,369
questions how long time remainder for

1207
00:53:46,359 --> 00:53:44,660
the mission for Hubble I think we've

1208
00:53:48,490 --> 00:53:46,369
pretty much covered that part there

1209
00:53:51,640 --> 00:53:48,500
ascot am I missing anything is that I do

1210
00:53:53,079 --> 00:53:51,650
have some from Twitter as well where are

1211
00:53:55,900 --> 00:53:53,089
you looking they're not using Hubble

1212
00:53:57,790 --> 00:53:55,910
hang out no we're communicating back and

1213
00:54:00,670 --> 00:53:57,800

forth with me now from a thread so

1214
00:54:01,960 --> 00:54:00,680
you're in charge of driving the internet

1215
00:54:04,020 --> 00:54:01,970
tell me you've known this for a while I

1216
00:54:06,790 --> 00:54:04,030
know that about now I should know better

1217
00:54:09,220 --> 00:54:06,800
so it's actually follow ups from summer

1218
00:54:12,040 --> 00:54:09,230
I was wondering is Callisto too far out

1219
00:54:15,430 --> 00:54:12,050
to interact in that way with Jupiter and

1220
00:54:19,990 --> 00:54:15,440
also are there any natural satellites

1221
00:54:23,680 --> 00:54:20,000
interacting with Saturn's Aurora so as

1222
00:54:26,559 --> 00:54:23,690
for Jupiter the the interaction between

1223
00:54:28,390 --> 00:54:26,569
Callisto and jupiter has been guests for

1224
00:54:31,329 --> 00:54:28,400
a long time ago and to my knowledge

1225
00:54:34,720 --> 00:54:31,339
there has only been one possible

1226
00:54:37,990 --> 00:54:34,730
detection by a colleague of Boston which

1227
00:54:39,940 --> 00:54:38,000
is enriched yet so if any interaction

1228
00:54:42,220 --> 00:54:39,950
with at least shows that this shall be

1229
00:54:45,520 --> 00:54:42,230
very transient so calloused Oh shall

1230
00:54:46,750 --> 00:54:45,530
have a different type of interaction

1231
00:54:49,000 --> 00:54:46,760
with respect to the other Galilean

1232
00:54:54,190 --> 00:54:49,010
satellites probably or less conductive

1233
00:54:57,030 --> 00:54:54,200
exosphere and as for sat on the Cassini

1234
00:55:02,740 --> 00:54:57,040
mission recently discovered that

1235
00:55:05,049 --> 00:55:02,750
Enceladus is behaving as I yo does with

1236
00:55:07,299 --> 00:55:05,059
Jupiter and as Enceladus with Sachin

1237
00:55:09,760 --> 00:55:07,309
which means that Enceladus is producing

1238
00:55:13,420 --> 00:55:09,770

a footprint in oral emissions and you

1239
00:55:16,359 --> 00:55:13,430
may see this on picture that was that

1240
00:55:20,890 --> 00:55:16,369
may harden hands Scott a wind generator

1241
00:55:23,200 --> 00:55:20,900
the second which displays actually a

1242
00:55:26,890 --> 00:55:23,210
picture of Sachin we did not speak about

1243
00:55:28,600 --> 00:55:26,900
Saturn yet I knew you see there these

1244
00:55:31,490 --> 00:55:28,610
models

1245
00:55:33,620 --> 00:55:31,500
pictures taken by a doll where you see

1246
00:55:35,930 --> 00:55:33,630
the the very valuable nature of Israel

1247
00:55:38,450 --> 00:55:35,940
emissions in particular the bright one

1248
00:55:40,940 --> 00:55:38,460
at the middle was produced by Halloween

1249
00:55:42,680 --> 00:55:40,950
compression reaching the planet so this

1250
00:55:47,450 --> 00:55:42,690
is an illustration and on the following

1251
00:55:51,070 --> 00:55:47,460
picture this is figured that was taken

1252
00:55:54,560 --> 00:55:51,080
by the Cassini UV spectrum major and

1253
00:56:02,150 --> 00:55:54,570
which with is actually a spot which is

1254
00:56:04,180 --> 00:56:02,160
linked to no not that one a spot which

1255
00:56:08,870 --> 00:56:04,190
which is named to Enceladus exactly as

1256
00:56:10,640 --> 00:56:08,880
as for i/o so and the fact interest with

1257
00:56:12,440 --> 00:56:10,650
cases under the main advantage of

1258
00:56:14,690 --> 00:56:12,450
Kissimmee was that it was that we could

1259
00:56:17,540 --> 00:56:14,700
we were able to get in situ measurements

1260
00:56:20,180 --> 00:56:17,550
and so so that's that picture you see

1261
00:56:22,610 --> 00:56:20,190
that when the spacecraft was crossing

1262
00:56:25,960 --> 00:56:22,620
the flics tube relating and salad

1263
00:56:29,920 --> 00:56:25,970

reduced to two sat on it was able to

1264
00:56:33,530 --> 00:56:29,930
acquire in situ measurements of plasma

1265
00:56:36,650 --> 00:56:33,540
traveling along these felines and then

1266
00:56:39,440 --> 00:56:36,660
remotely observe with a UV dress code

1267
00:56:41,390 --> 00:56:39,450
the the rural context under the surface

1268
00:56:44,600 --> 00:56:41,400
after on the atmosphere the planet and

1269
00:56:47,000 --> 00:56:44,610
so with these set of measurements we got

1270
00:56:49,870 --> 00:56:47,010
these two informations both remotely and

1271
00:56:52,730 --> 00:56:49,880
Institute and we could diagnose the full

1272
00:56:57,080 --> 00:56:52,740
electric current which is coupling and

1273
00:56:58,820 --> 00:56:57,090
said I just to its host planet alright

1274
00:57:00,950 --> 00:56:58,830
great thank you so we're running out of

1275
00:57:03,380 --> 00:57:00,960
time and I i wanna i want to thank

1276
00:57:05,150 --> 00:57:03,390
laurent lemme for joining us on talking

1277
00:57:07,190 --> 00:57:05,160
about planetary aurora he's from the

1278
00:57:08,600 --> 00:57:07,200
observatory of Paris they moved on Thank

1279
00:57:12,020 --> 00:57:08,610
You Laura and I appreciate your time

1280
00:57:13,390 --> 00:57:12,030
today yeah so before and before i go i

1281
00:57:19,100 --> 00:57:13,400
just want to i want to highlight one

1282
00:57:21,530 --> 00:57:19,110
comment from YouTube that is say this is

1283
00:57:23,210 --> 00:57:21,540
from George Lloyd who goes hi Tony

1284
00:57:24,410 --> 00:57:23,220
Carolyn Scott I'm a subscriber people

1285
00:57:25,910 --> 00:57:24,420
strana me space fan news and have just

1286
00:57:27,800 --> 00:57:25,920
stumbled onto this channel I was

1287
00:57:30,410 --> 00:57:27,810
wondering how do I find out when other

1288
00:57:31,940 --> 00:57:30,420

live hangouts happen and reason I wanted

1289
00:57:33,800 --> 00:57:31,950
to highlight that is he owes I never

1290
00:57:36,170 --> 00:57:33,810
know when they're on and would maybe

1291
00:57:38,830 --> 00:57:36,180
like to ask a question live well Lloyd

1292
00:57:40,880 --> 00:57:38,840
the best way to find out is to is to

1293
00:57:42,050 --> 00:57:40,890
subscribe to this channel which is your

1294
00:57:44,570 --> 00:57:42,060
first step you'll get that note

1295
00:57:46,370 --> 00:57:44,580
vacation when it goes live we are if you

1296
00:57:48,440 --> 00:57:46,380
also follow Hubble telescope and deep

1297
00:57:50,300 --> 00:57:48,450
astronomy and scientific Scott on

1298
00:57:52,490 --> 00:57:50,310
Twitter you'll be able to get what we

1299
00:57:55,000 --> 00:57:52,500
are constantly letting people know and

1300
00:57:59,150 --> 00:57:55,010
finally I'm shut up I'm always tweeting

1301
00:58:00,590 --> 00:57:59,160
boy oh and so the so that's that's

1302
00:58:03,500 --> 00:58:00,600
another great way to find out about when

1303
00:58:04,940 --> 00:58:03,510
we're having these also Carol Scott and

1304
00:58:07,010 --> 00:58:04,950
I are being very you know we're working

1305
00:58:08,240 --> 00:58:07,020
on a schedule that is that is we're

1306
00:58:10,610 --> 00:58:08,250
going to be doing these for the most

1307
00:58:12,830 --> 00:58:10,620
part every single thursday at three pm

1308
00:58:16,970 --> 00:58:12,840
eastern witch in the UK is seven o'clock

1309
00:58:19,070 --> 00:58:16,980
your time so I so that's the best way to

1310
00:58:21,500 --> 00:58:19,080
find out whether another thing I'll

1311
00:58:23,600 --> 00:58:21,510
mention if you google Hubble hangouts

1312
00:58:26,990 --> 00:58:23,610
you will find the web page that often

1313
00:58:28,550 --> 00:58:27,000

has what the next topic is yes we might

1314
00:58:30,560 --> 00:58:28,560
take a little vacation at the end of

1315
00:58:32,590 --> 00:58:30,570
august but mostly it'll be every

1316
00:58:35,420 --> 00:58:32,600
thursday at three unless our guest

1317
00:58:37,220 --> 00:58:35,430
absolutely cannot be with us at that

1318
00:58:40,220 --> 00:58:37,230
time and then we'll reschedule it but we

1319
00:58:42,200 --> 00:58:40,230
are trying about equations I know you

1320
00:58:50,180 --> 00:58:42,210
are not I didn't say anything about you

1321
00:58:53,210 --> 00:58:50,190
that's right so okay so that's it for

1322
00:58:55,040 --> 00:58:53,220
this week's folks next week we are we

1323
00:58:57,170 --> 00:58:55,050
are going to be having a hang out with

1324
00:58:59,690 --> 00:58:57,180
some of the people with the Institute on

1325
00:59:01,550 --> 00:58:59,700
the process of decide we're going to

1326
00:59:03,380 --> 00:59:01,560
talk about how do you get to use Hubble

1327
00:59:05,000 --> 00:59:03,390
what's it like what do you got to go

1328
00:59:07,850 --> 00:59:05,010
through to get Hubble time Lauren knows

1329
00:59:09,740 --> 00:59:07,860
because he's had to go through it up

1330
00:59:10,970 --> 00:59:09,750
with members of the time allocation

1331
00:59:13,760 --> 00:59:10,980
committee and we're going to talk about

1332
00:59:16,970 --> 00:59:13,770
how one goes about getting Hubble time

1333
00:59:18,740 --> 00:59:16,980
how what how was it decided what Hubble

1334
00:59:20,030 --> 00:59:18,750
looks at one of the things that I like

1335
00:59:22,010 --> 00:59:20,040
you know people I think have a little

1336
00:59:23,960 --> 00:59:22,020
misconception of what hubble hubble is

1337
00:59:25,460 --> 00:59:23,970
about as general purpose of telescope as

1338
00:59:28,040 --> 00:59:25,470

you're going to find in space but it was

1339
00:59:30,500 --> 00:59:28,050
really designed to look for dim warm

1340
00:59:32,870 --> 00:59:30,510
things and so very very dim things or

1341
00:59:33,800 --> 00:59:32,880
what itwhat itwhat it excels at so

1342
00:59:36,710 --> 00:59:33,810
that's what we're going to be talking

1343
00:59:39,140 --> 00:59:36,720
about that next week on behalf of carol

1344
00:59:41,030 --> 00:59:39,150
christian scott lewis and lord dr.

1345
00:59:43,430 --> 00:59:41,040
lauren le'me i would like to thank you