

1  
00:00:00,949 --> 00:00:05,790  
there we go hello everybody and welcome

2  
00:00:03,750 --> 00:00:06,960  
to our latest hub will hang out my name

3  
00:00:05,790 --> 00:00:08,970  
is Tony Darnell at work in the space

4  
00:00:06,960 --> 00:00:10,769  
telescope science institute and today we

5  
00:00:08,970 --> 00:00:11,849  
have a really interesting hangout plan

6  
00:00:10,769 --> 00:00:13,980  
for you we're going to be talking with

7  
00:00:11,849 --> 00:00:16,410  
dr. loretta let me from the university

8  
00:00:13,980 --> 00:00:20,760  
of paris in mood all about planetary

9  
00:00:16,410 --> 00:00:21,929  
iori Aurora's Aurora one of those three

10  
00:00:20,760 --> 00:00:24,539  
are right i'm not sure which one but

11  
00:00:21,929 --> 00:00:26,698  
they all sound wrong so what we talked

12  
00:00:24,539 --> 00:00:29,189  
we hope that you will interact with us

13  
00:00:26,699 --> 00:00:32,099  
and talk about all things planetary

14  
00:00:29,189 --> 00:00:33,450  
Aurora today ah before I get to the

15  
00:00:32,098 --> 00:00:35,609  
introductions let me just say very

16  
00:00:33,450 --> 00:00:37,320  
briefly that you we hope you will

17  
00:00:35,609 --> 00:00:39,119  
interact with us you will give us

18  
00:00:37,320 --> 00:00:40,920  
comments and questions where you can do

19  
00:00:39,119 --> 00:00:42,780  
it in a wide variety of ways the Q&A app

20  
00:00:40,920 --> 00:00:44,700  
is the best way to do it you can see

21  
00:00:42,780 --> 00:00:46,469  
that on both google and youtube so you

22  
00:00:44,700 --> 00:00:48,590  
just click on that thing and type in a

23  
00:00:46,469 --> 00:00:50,789  
question and it will appear magically on

24  
00:00:48,590 --> 00:00:51,930  
to our little panel here and i'll be

25  
00:00:50,789 --> 00:00:54,448  
able to see the question you can also

26  
00:00:51,929 --> 00:00:57,840  
tweet at us with Hubble hashtag or

27  
00:00:54,448 --> 00:00:59,218  
Hubble hang out hashtag hang it three

28  
00:00:57,840 --> 00:01:03,090  
times a week I'm going to get that right

29

00:00:59,219 --> 00:01:04,769  
well handling as well as all you can

30  
00:01:03,090 --> 00:01:06,150  
also comment on YouTube and the Google+

31  
00:01:04,769 --> 00:01:09,210  
event page where this is being broadcast

32  
00:01:06,150 --> 00:01:10,650  
so we hope you'll do it please leave us

33  
00:01:09,209 --> 00:01:12,000  
questions and comments about anything

34  
00:01:10,650 --> 00:01:14,640  
related to Hubble and we'll try to get

35  
00:01:12,000 --> 00:01:18,180  
them as well so with me this week as I

36  
00:01:14,640 --> 00:01:20,099  
said before is dr. Laurent lemme from

37  
00:01:18,180 --> 00:01:23,820  
the University of Paris a mood on he

38  
00:01:20,099 --> 00:01:25,169  
studies Aurora's and he's with us today

39  
00:01:23,819 --> 00:01:27,658  
to give us he's been using the Hubble

40  
00:01:25,170 --> 00:01:29,700  
Space Telescope to look not at the ones

41  
00:01:27,659 --> 00:01:31,618  
within our own planet but ones within

42  
00:01:29,700 --> 00:01:34,290  
our solar system so welcome Laurent was

43  
00:01:31,618 --> 00:01:36,629

looking forward to talking with you also

44

00:01:34,290 --> 00:01:38,490

with me as always are my very good

45

00:01:36,629 --> 00:01:40,859

friends dr. carol christian from the

46

00:01:38,489 --> 00:01:43,919

Space Telescope Science Institute she is

47

00:01:40,859 --> 00:01:45,688

a an astronomer here and wonderful

48

00:01:43,920 --> 00:01:48,060

wonderful insights and great great

49

00:01:45,688 --> 00:01:49,919

feedback from an information from Hubble

50

00:01:48,060 --> 00:01:52,859

as well as my good friend scott lewis

51

00:01:49,920 --> 00:01:54,618

from know the cosmos calm and he's here

52

00:01:52,859 --> 00:01:58,078

to also help out so welcome everybody

53

00:01:54,618 --> 00:01:59,519

let's get started first of all what's

54

00:01:58,078 --> 00:02:05,609

the appropriate what's the right way to

55

00:01:59,519 --> 00:02:07,859

say the plural of aurora oh okay since i

56

00:02:05,609 --> 00:02:10,378

seem to struggle with that was not

57

00:02:07,859 --> 00:02:12,210

planet or actually i'm personally using

58  
00:02:10,378 --> 00:02:15,090  
or all right

59  
00:02:12,210 --> 00:02:17,730  
is that Nigerian form and I think

60  
00:02:15,090 --> 00:02:20,520  
Aurora's is the u.s. translation of that

61  
00:02:17,729 --> 00:02:22,859  
but feel free to use the word you p sure

62  
00:02:20,520 --> 00:02:25,200  
they all sound wrong to me so whichever

63  
00:02:22,860 --> 00:02:28,380  
one so i prefer i'm gonna use Aurora's

64  
00:02:25,199 --> 00:02:31,319  
just because it sounds better i guess so

65  
00:02:28,379 --> 00:02:33,629  
although read what better in that case

66  
00:02:31,319 --> 00:02:35,400  
is to speak about oral emissions so that

67  
00:02:33,629 --> 00:02:37,590  
you call they're all these a curious

68  
00:02:35,400 --> 00:02:39,420  
emissions as a bench and you do not have

69  
00:02:37,590 --> 00:02:42,479  
to think about your own record to use

70  
00:02:39,419 --> 00:02:45,359  
there you go I like that all right well

71  
00:02:42,479 --> 00:02:46,739  
the good good advice okay so let's talk

72  
00:02:45,360 --> 00:02:49,890  
about so let's talk a little bit about

73  
00:02:46,740 --> 00:02:52,890  
the general topic of these rural

74  
00:02:49,889 --> 00:02:56,099  
emissions as you call them we see them

75  
00:02:52,889 --> 00:02:57,659  
here on earth they they as you are going

76  
00:02:56,099 --> 00:03:00,960  
to show us that we've seen them on other

77  
00:02:57,659 --> 00:03:02,969  
planets are they so what what can you

78  
00:03:00,960 --> 00:03:04,500  
give me the most general definition of

79  
00:03:02,969 --> 00:03:07,740  
what these things are what is this

80  
00:03:04,500 --> 00:03:10,169  
phenomenon that's that's a good way to

81  
00:03:07,740 --> 00:03:13,170  
begin with since people do not generally

82  
00:03:10,169 --> 00:03:16,169  
agree on how what to call or I these

83  
00:03:13,169 --> 00:03:19,530  
days but historically oral emissions

84  
00:03:16,169 --> 00:03:22,229  
refer to these in 10 slides that were

85  
00:03:19,530 --> 00:03:26,390  
seen on earth's atmosphere for decades

86

00:03:22,229 --> 00:03:30,449  
in the visible light visible domain so

87  
00:03:26,389 --> 00:03:34,619  
this remains then as I mean these

88  
00:03:30,449 --> 00:03:39,209  
categories of luminous emissions from

89  
00:03:34,620 --> 00:03:41,789  
the atmosphere and then with the study

90  
00:03:39,210 --> 00:03:43,890  
of the other planets and and I mean the

91  
00:03:41,789 --> 00:03:46,379  
study of oral processes from space we

92  
00:03:43,889 --> 00:03:48,509  
discovered or I also about the

93  
00:03:46,379 --> 00:03:50,400  
atmosphere and so now we are more

94  
00:03:48,509 --> 00:03:52,949  
generally speaking about oral emissions

95  
00:03:50,400 --> 00:03:56,939  
which consists actually in a series of

96  
00:03:52,949 --> 00:03:59,310  
different emission processes so both in

97  
00:03:56,939 --> 00:04:01,979  
the atmosphere and above the atmosphere

98  
00:03:59,310 --> 00:04:05,069  
in the surrounding environment of the

99  
00:04:01,979 --> 00:04:08,299  
magnetized panics in the atmosphere and

100  
00:04:05,069 --> 00:04:10,530

above the atmosphere so not cool so what

101

00:04:08,300 --> 00:04:12,600

but that doesn't let it I also don't get

102

00:04:10,530 --> 00:04:14,669

it what are they what is causing these

103

00:04:12,599 --> 00:04:16,560

emissions is it is it different

104

00:04:14,669 --> 00:04:19,680

depending on the planet is that why we

105

00:04:16,560 --> 00:04:21,720

can't get more specific than that or we

106

00:04:19,680 --> 00:04:25,449

could say that we have the same series

107

00:04:21,720 --> 00:04:27,580

of production processes which exist at

108

00:04:25,449 --> 00:04:29,620

all planets but the species which are

109

00:04:27,579 --> 00:04:32,409

excited the atmospheric species in

110

00:04:29,620 --> 00:04:35,139

particular may be different so for

111

00:04:32,410 --> 00:04:37,840

instance on earth the visible light we

112

00:04:35,139 --> 00:04:40,959

see in the sky come directly from the

113

00:04:37,839 --> 00:04:43,329

collision between charged particles

114

00:04:40,959 --> 00:04:46,120

which come from the neighborhood at the



115  
00:04:43,329 --> 00:04:48,399  
earth and which collide with the neutral

116  
00:04:46,120 --> 00:04:51,610  
atmosphere so the neutral atmosphere act

117  
00:04:48,399 --> 00:04:53,919  
as a screen where energetic particles

118  
00:04:51,610 --> 00:04:56,080  
fall down actually we say that they

119  
00:04:53,920 --> 00:04:59,230  
precipitate and they transfer energy

120  
00:04:56,079 --> 00:05:02,409  
which is then re-radiated by the

121  
00:04:59,230 --> 00:05:05,740  
atmosphere thus the right we see the

122  
00:05:02,410 --> 00:05:08,530  
wavelength domain they consist of depend

123  
00:05:05,740 --> 00:05:11,560  
on the atmospheric composition and at

124  
00:05:08,529 --> 00:05:14,889  
earth the most relative species are

125  
00:05:11,560 --> 00:05:16,600  
nitrogen and oxygen which are able to i

126  
00:05:14,889 --> 00:05:19,269  
did in the visible government

127  
00:05:16,600 --> 00:05:21,910  
essentially and so saying i have a

128  
00:05:19,269 --> 00:05:23,680  
question so do you need in on every

129  
00:05:21,910 --> 00:05:25,900  
planet in the solar system do you need a

130  
00:05:23,680 --> 00:05:28,000  
magnetic field to get those charged

131  
00:05:25,899 --> 00:05:32,379  
particles or can you have a Roura

132  
00:05:28,000 --> 00:05:35,980  
without magnetic fields so generally

133  
00:05:32,379 --> 00:05:39,339  
speaking oral processes are actually

134  
00:05:35,980 --> 00:05:43,030  
only seen on magnetized planets so to

135  
00:05:39,339 --> 00:05:46,719  
have to generate these particles which

136  
00:05:43,029 --> 00:05:51,819  
at the end will excite the atmosphere

137  
00:05:46,720 --> 00:05:54,490  
you need a magnetic field which then

138  
00:05:51,819 --> 00:05:57,730  
produces what we call a magnetosphere so

139  
00:05:54,490 --> 00:06:01,780  
I think Tony if Scott if you agree is

140  
00:05:57,730 --> 00:06:04,780  
true to show the first picture with

141  
00:06:01,779 --> 00:06:07,929  
magnetospheres can show graphics well

142  
00:06:04,779 --> 00:06:11,969  
you are schematics of the solar system

143

00:06:07,930 --> 00:06:16,629  
with values magnetized planets and these

144  
00:06:11,970 --> 00:06:19,990  
its current has a cup now ah okay so so

145  
00:06:16,629 --> 00:06:22,709  
basically a magnetic field is creating

146  
00:06:19,990 --> 00:06:25,150  
in the neighborhood of the the planets

147  
00:06:22,709 --> 00:06:27,159  
cavity which we call a magnetosphere and

148  
00:06:25,149 --> 00:06:30,959  
this is this cavity which has the

149  
00:06:27,160 --> 00:06:33,910  
ability they are complex phenomena to

150  
00:06:30,959 --> 00:06:36,909  
accelerate charged particles with which

151  
00:06:33,910 --> 00:06:39,460  
then will be guided along magnetic field

152  
00:06:36,910 --> 00:06:41,229  
line down to the polar region

153  
00:06:39,459 --> 00:06:44,138  
they can collide with each other

154  
00:06:41,228 --> 00:06:45,758  
atmosphere so what we're sticking with

155  
00:06:44,139 --> 00:06:47,139  
earth just for a minute before we go off

156  
00:06:45,759 --> 00:06:49,449  
these other planets for a second we have

157  
00:06:47,139 --> 00:06:51,038

obviously we have a magnetic field that

158

00:06:49,449 --> 00:06:52,270

the particles are coming from the Sun

159

00:06:51,038 --> 00:06:54,370

charged particles from the Sun

160

00:06:52,269 --> 00:06:56,948

presumably electrons from the solar wind

161

00:06:54,370 --> 00:06:59,348

coming in following the magnetic field

162

00:06:56,949 --> 00:07:00,460

down and as you say hit these neutral

163

00:06:59,348 --> 00:07:03,519

particles high in the atmosphere

164

00:07:00,459 --> 00:07:05,379

primarily nice oxygen since that's what

165

00:07:03,519 --> 00:07:07,719

the earth is made their sadness was

166

00:07:05,379 --> 00:07:10,209

primarily made up and they glow they

167

00:07:07,720 --> 00:07:14,610

emit this light which is generally on

168

00:07:10,209 --> 00:07:19,478

earth green right Bri Nick Gregory

169

00:07:14,610 --> 00:07:23,199

postural the reason for that is due to

170

00:07:19,478 --> 00:07:25,379

an account come come physics which which

171

00:07:23,199 --> 00:07:29,169

mean that when you have a molecule or

172  
00:07:25,379 --> 00:07:31,689  
not on its able to radiate in a specific

173  
00:07:29,168 --> 00:07:35,288  
series of transition which produce like

174  
00:07:31,689 --> 00:07:37,740  
to actually the Earth's oral emissions

175  
00:07:35,288 --> 00:07:41,318  
in the atmosphere are not simply green

176  
00:07:37,740 --> 00:07:42,788  
no red nor only purple I know that was

177  
00:07:41,319 --> 00:07:45,250  
an oversimplification but they're also

178  
00:07:42,788 --> 00:07:48,478  
agree okay they cover a wide spectrum

179  
00:07:45,250 --> 00:07:51,129  
with a few very intense line which give

180  
00:07:48,478 --> 00:07:54,250  
the impression that visa missions are

181  
00:07:51,129 --> 00:07:58,870  
very colored in a very very specific

182  
00:07:54,250 --> 00:08:03,038  
transitions okay so the other lovely

183  
00:07:58,870 --> 00:08:05,199  
also ahead we like just to come back on

184  
00:08:03,038 --> 00:08:07,990  
something that you say quickly actually

185  
00:08:05,199 --> 00:08:11,228  
the charged particles we are dealing

186  
00:08:07,990 --> 00:08:14,710  
with I'm not directly coming from the

187  
00:08:11,228 --> 00:08:17,250  
Sun or more specifically from the solar

188  
00:08:14,709 --> 00:08:19,508  
wind actually these cavity which is

189  
00:08:17,250 --> 00:08:22,689  
produced by magnetic field planetary

190  
00:08:19,509 --> 00:08:25,629  
magnetic field is at first order

191  
00:08:22,689 --> 00:08:28,959  
deviating the solar wing on the edges of

192  
00:08:25,629 --> 00:08:31,689  
that cavity so that at first order this

193  
00:08:28,959 --> 00:08:33,370  
is a plasma proof when I say the

194  
00:08:31,689 --> 00:08:35,500  
particles of the solar we cannot

195  
00:08:33,370 --> 00:08:37,658  
penetrate into the magnetosphere so

196  
00:08:35,500 --> 00:08:40,269  
those charged particles and there are

197  
00:08:37,658 --> 00:08:42,639  
some complex phenomena may be able to

198  
00:08:40,269 --> 00:08:45,610  
enter in somewhere because this is not

199  
00:08:42,639 --> 00:08:48,220  
always a plasma proof but these

200

00:08:45,610 --> 00:08:51,039  
particles before to produce aurora have to

201  
00:08:48,220 --> 00:08:52,528  
be sort of reprocessed by the

202  
00:08:51,039 --> 00:08:55,198  
magnetosphere which will

203  
00:08:52,528 --> 00:08:57,688  
accelerate them transfer energy to them

204  
00:08:55,198 --> 00:09:00,448  
before they will be able to to emit or

205  
00:08:57,688 --> 00:09:03,179  
us so the link between Salah mean and

206  
00:09:00,448 --> 00:09:05,998  
the lights we see the atmosphere is not

207  
00:09:03,179 --> 00:09:08,758  
direct I don't understand so you're

208  
00:09:05,999 --> 00:09:11,519  
telling me that that the the particles

209  
00:09:08,759 --> 00:09:12,839  
from the solar wind are following the

210  
00:09:11,519 --> 00:09:15,179  
field lines and if you look at what

211  
00:09:12,839 --> 00:09:17,519  
Scott has up those field lines are shown

212  
00:09:15,179 --> 00:09:20,188  
in those yellow lines there what we

213  
00:09:17,519 --> 00:09:22,289  
actually see emitted by the time we see

214  
00:09:20,188 --> 00:09:25,438

the light is not due to the solar wind

215

00:09:22,289 --> 00:09:27,419  
particles so and if you want to

216

00:09:25,438 --> 00:09:29,610  
understand this simply we can just

217

00:09:27,419 --> 00:09:32,578  
consider the fact that the charged

218

00:09:29,610 --> 00:09:35,220  
particles which are carried by the solar

219

00:09:32,578 --> 00:09:38,609  
wind are not energetic enough to produce

220

00:09:35,220 --> 00:09:41,730  
or all emissions right this is the first

221

00:09:38,610 --> 00:09:44,220  
point so we agreed we need something to

222

00:09:41,730 --> 00:09:46,409  
twirl to transfer energy to these

223

00:09:44,220 --> 00:09:47,939  
particles because they can be good

224

00:09:46,409 --> 00:09:49,769  
candidates to produce these emissions

225

00:09:47,938 --> 00:09:52,438  
this is the first point the second point

226

00:09:49,769 --> 00:09:54,659  
is that at Earth oral emissions are

227

00:09:52,438 --> 00:09:57,360  
mostly produced on the night side of the

228

00:09:54,659 --> 00:09:59,429  
planet so the night side means that you



229  
00:09:57,360 --> 00:10:01,949  
are not facing the same so there cannot

230  
00:09:59,429 --> 00:10:04,109  
be a direct link between these particles

231  
00:10:01,948 --> 00:10:06,389  
which are coming from the Sun and the

232  
00:10:04,110 --> 00:10:08,879  
these powerful emission which are seen

233  
00:10:06,389 --> 00:10:11,698  
on the night side of the planet so I was

234  
00:10:08,879 --> 00:10:14,009  
simply saying that these particles which

235  
00:10:11,698 --> 00:10:17,338  
are arriving with which are transported

236  
00:10:14,009 --> 00:10:19,528  
by solar wind are not directly

237  
00:10:17,339 --> 00:10:21,750  
responsible for the emissions receive

238  
00:10:19,528 --> 00:10:23,539  
they need first to enter into the

239  
00:10:21,750 --> 00:10:26,429  
magnetosphere other of some complex

240  
00:10:23,539 --> 00:10:29,068  
conditions and then to be reprocessed to

241  
00:10:26,429 --> 00:10:31,888  
be warmed to be accelerated before they

242  
00:10:29,068 --> 00:10:34,169  
can then give rise to oral emissions on

243  
00:10:31,889 --> 00:10:35,730  
the night side of the planet got it okay

244  
00:10:34,169 --> 00:10:37,438  
so the key word where was it was

245  
00:10:35,730 --> 00:10:39,808  
accelerated it seems to me like you need

246  
00:10:37,438 --> 00:10:42,360  
to get these particles more energy than

247  
00:10:39,808 --> 00:10:45,568  
what they would have out in our if I get

248  
00:10:42,360 --> 00:10:47,129  
it now okay uh but I'm are you sure they

249  
00:10:45,568 --> 00:10:49,318  
don't happen during the day because and

250  
00:10:47,129 --> 00:10:52,019  
we just can't see them or they really

251  
00:10:49,318 --> 00:10:54,719  
don't happen during the day the

252  
00:10:52,019 --> 00:10:58,259  
situation is always a less simplistic

253  
00:10:54,720 --> 00:11:01,110  
than that we are explained so I was

254  
00:10:58,259 --> 00:11:02,909  
referring to intense alright which are

255  
00:11:01,110 --> 00:11:06,259  
seen on the night side of the earth of

256  
00:11:02,909 --> 00:11:09,059  
course they are all right all around

257

00:11:06,259 --> 00:11:11,970  
both magnetic poles and so that's why we

258  
00:11:09,059 --> 00:11:15,299  
are speaking about Paula all right and

259  
00:11:11,970 --> 00:11:16,950  
not simply borealis or I borealis

260  
00:11:15,299 --> 00:11:19,199  
because bobble is just refers to the

261  
00:11:16,950 --> 00:11:21,480  
northern hemisphere and I also write in

262  
00:11:19,200 --> 00:11:24,270  
the south on a Miss fear sauce rice all

263  
00:11:21,480 --> 00:11:27,839  
right and so they're all right all

264  
00:11:24,269 --> 00:11:31,350  
around these are these magnetic poles

265  
00:11:27,839 --> 00:11:34,170  
forming what we call oral ovals but the

266  
00:11:31,350 --> 00:11:36,300  
oboes euro ovals themselves which are

267  
00:11:34,169 --> 00:11:38,789  
centered on magnetic poles are knowing

268  
00:11:36,299 --> 00:11:41,579  
terms of the night side so you are faint

269  
00:11:38,789 --> 00:11:43,740  
all right on the on the day side the

270  
00:11:41,580 --> 00:11:46,680  
issue is that as visitations are very

271  
00:11:43,740 --> 00:11:48,690

faint we are generally not able to see

272

00:11:46,679 --> 00:11:50,819

them because the contrast is too faint

273

00:11:48,690 --> 00:11:53,490

on the on the day side to catch them in

274

00:11:50,820 --> 00:11:54,420

this guy okay Carol I think I cut you

275

00:11:53,490 --> 00:11:57,509

off when you're trying to say something

276

00:11:54,419 --> 00:12:00,449

did you want to put add to this no no no

277

00:11:57,509 --> 00:12:02,700

Lauren explained it that the the solar

278

00:12:00,450 --> 00:12:04,980

wind particles can then interact with

279

00:12:02,700 --> 00:12:08,040

stuff in the magnetosphere which then

280

00:12:04,980 --> 00:12:10,170

can cascade and and interact with the

281

00:12:08,039 --> 00:12:14,309

atmosphere so there can be a transition

282

00:12:10,169 --> 00:12:16,620

zone and acceleration was one of the

283

00:12:14,309 --> 00:12:18,629

keys is that they have to accelerate too

284

00:12:16,620 --> 00:12:21,269

and the magnetic field helps with that

285

00:12:18,629 --> 00:12:22,980

okay why I think I think we've

286  
00:12:21,269 --> 00:12:24,569  
established what these things are in a

287  
00:12:22,980 --> 00:12:27,539  
general sense Lauren let me ask you this

288  
00:12:24,570 --> 00:12:29,370  
now what is your what what got you into

289  
00:12:27,539 --> 00:12:32,129  
this what is your research interest in

290  
00:12:29,370 --> 00:12:36,000  
in studying these things on other

291  
00:12:32,129 --> 00:12:38,850  
planets what got you go in on this so my

292  
00:12:36,000 --> 00:12:40,919  
purpose of interest is to try to take

293  
00:12:38,850 --> 00:12:43,649  
advantage take benefit of these oil

294  
00:12:40,919 --> 00:12:45,990  
emissions which can be sensed remotely

295  
00:12:43,649 --> 00:12:49,769  
by your telescopes as adult for instance

296  
00:12:45,990 --> 00:12:51,778  
to diagnose to study planetary

297  
00:12:49,769 --> 00:12:54,629  
magnetospheres because generally

298  
00:12:51,778 --> 00:12:57,600  
speaking a magnetic field cannot be

299  
00:12:54,629 --> 00:13:00,240  
stood out over than Institute with

300  
00:12:57,600 --> 00:13:03,120  
special measurements that can be done

301  
00:13:00,240 --> 00:13:06,360  
with spacecraft exploring the various

302  
00:13:03,120 --> 00:13:07,860  
planets of the solar system but when we

303  
00:13:06,360 --> 00:13:10,019  
do not have the possibility to send

304  
00:13:07,860 --> 00:13:13,169  
spacecraft around magnetics planet and

305  
00:13:10,019 --> 00:13:15,899  
our all emissions remain useful and

306  
00:13:13,169 --> 00:13:19,139  
powerful tool to investigate remotely

307  
00:13:15,899 --> 00:13:20,009  
the physics of this magnetosphere so my

308  
00:13:19,139 --> 00:13:22,470  
purpose is

309  
00:13:20,009 --> 00:13:26,189  
try to take advantage of these emissions

310  
00:13:22,470 --> 00:13:29,340  
to take all the informations that they

311  
00:13:26,190 --> 00:13:33,140  
carry down and then to explain the

312  
00:13:29,340 --> 00:13:35,730  
physics of the magnetosphere liable to

313  
00:13:33,139 --> 00:13:37,169  
thank you and your primarily and you've

314

00:13:35,730 --> 00:13:39,990  
been using the Hubble Space Telescope

315  
00:13:37,169 --> 00:13:43,349  
for a lot is correct yes that's correct

316  
00:13:39,990 --> 00:13:46,379  
because as for the outer planets so the

317  
00:13:43,350 --> 00:13:49,230  
planet beyond the orbit of the earth the

318  
00:13:46,379 --> 00:13:51,419  
composition of the atmosphere is as for

319  
00:13:49,230 --> 00:13:54,960  
the giant planets generally dominated by

320  
00:13:51,419 --> 00:13:56,429  
a hydrogenic species so the atmosphere

321  
00:13:54,960 --> 00:13:58,190  
compound atmospheric composition is

322  
00:13:56,429 --> 00:14:01,139  
different from that from the earth and

323  
00:13:58,190 --> 00:14:03,660  
this atmospheric composition as the

324  
00:14:01,139 --> 00:14:06,960  
ability at the capability to radiate in

325  
00:14:03,659 --> 00:14:10,980  
the UV window and that word is

326  
00:14:06,960 --> 00:14:13,710  
particularly able to look at so there is

327  
00:14:10,980 --> 00:14:17,610  
a very powerful tool to look at the aura

328  
00:14:13,710 --> 00:14:18,600

of other planets that yet you know you

329

00:14:17,610 --> 00:14:20,159

know Carol one of the things I'm

330

00:14:18,600 --> 00:14:23,370

noticing in these hangouts lately is

331

00:14:20,159 --> 00:14:26,370

that awful lot of people are using the

332

00:14:23,370 --> 00:14:27,750

UV capabilities of Hubble we know last

333

00:14:26,370 --> 00:14:28,710

few hangouts we've had we've we talked

334

00:14:27,750 --> 00:14:30,929

about this that's been a really

335

00:14:28,710 --> 00:14:32,639

important part of people using the

336

00:14:30,929 --> 00:14:33,899

Hubble I guess I always looked at it as

337

00:14:32,639 --> 00:14:35,340

more of an infrared instrument but you

338

00:14:33,899 --> 00:14:37,949

know we have a lot of people using the

339

00:14:35,340 --> 00:14:41,160

UV as well so yeah and i think i think

340

00:14:37,950 --> 00:14:42,509

what started was of course because we

341

00:14:41,159 --> 00:14:44,399

have a lot of experience in ground-based

342

00:14:42,509 --> 00:14:46,230

astronomy we started with kind of the



343  
00:14:44,399 --> 00:14:47,970  
visual so we do a lot of the things that

344  
00:14:46,230 --> 00:14:50,730  
we know in the visual and then pushed

345  
00:14:47,970 --> 00:14:52,730  
into the infrared but the UV capability

346  
00:14:50,730 --> 00:14:56,129  
and the fact that we got new instruments

347  
00:14:52,730 --> 00:15:00,360  
that that assisted with that capability

348  
00:14:56,129 --> 00:15:04,019  
has really been powerful and when Hubble

349  
00:15:00,360 --> 00:15:06,690  
no longer is working we have no other UV

350  
00:15:04,019 --> 00:15:09,870  
capability in space and we can't get a

351  
00:15:06,690 --> 00:15:14,960  
UV on the ground so right now it is a

352  
00:15:09,870 --> 00:15:18,629  
young why is a source it's called money

353  
00:15:14,960 --> 00:15:22,170  
on the ground we can't to see the UV

354  
00:15:18,629 --> 00:15:26,009  
very far into the UV that's right I know

355  
00:15:22,169 --> 00:15:27,799  
I'm being facetious come on the ground

356  
00:15:26,009 --> 00:15:30,629  
we can't see because the atmosphere

357  
00:15:27,799 --> 00:15:33,149  
happily blocks it so that we're not all

358  
00:15:30,629 --> 00:15:33,720  
fried it's a good thing I'm going good

359  
00:15:33,149 --> 00:15:35,549  
thing

360  
00:15:33,720 --> 00:15:37,920  
the visual comes through a little bit of

361  
00:15:35,549 --> 00:15:40,109  
the infrared in certain places but the

362  
00:15:37,919 --> 00:15:43,649  
water vapor helps block the infrared and

363  
00:15:40,110 --> 00:15:45,959  
some of the radio as well so we need

364  
00:15:43,649 --> 00:15:49,139  
telescopes in space and Hubble right now

365  
00:15:45,958 --> 00:15:51,508  
is the one that has UV capability it may

366  
00:15:49,139 --> 00:15:54,959  
be that after 2020 there might be

367  
00:15:51,509 --> 00:15:57,839  
another telescope proposed to NASA that

368  
00:15:54,958 --> 00:15:59,758  
will have some UV capability but you're

369  
00:15:57,839 --> 00:16:02,930  
right the people are really looking to

370  
00:15:59,759 --> 00:16:05,459  
the UV to use Hubble in the UV um

371

00:16:02,929 --> 00:16:07,349  
because you need to know a lot of these

372  
00:16:05,458 --> 00:16:09,119  
phenomenon that you can't see in the

373  
00:16:07,350 --> 00:16:11,310  
visible or the infrared so it is an

374  
00:16:09,120 --> 00:16:12,269  
important aspect yeah it's an important

375  
00:16:11,309 --> 00:16:13,500  
wavelength one that I'm just now

376  
00:16:12,269 --> 00:16:15,539  
starting to appreciate with Hubble

377  
00:16:13,500 --> 00:16:17,100  
because of the recent hangouts we've had

378  
00:16:15,539 --> 00:16:19,438  
not to mention this one and as well as

379  
00:16:17,100 --> 00:16:22,850  
the the ultra deep field with just added

380  
00:16:19,438 --> 00:16:27,059  
UV as well so okay so yeah i had sorry i

381  
00:16:22,850 --> 00:16:30,180  
had to i had two questions one is when

382  
00:16:27,059 --> 00:16:32,609  
did astronomers first realize that the

383  
00:16:30,179 --> 00:16:34,708  
other planets had is this one of these

384  
00:16:32,610 --> 00:16:37,528  
things we always knew but we didn't you

385  
00:16:34,708 --> 00:16:40,500

know we didn't suspect it or we just

386

00:16:37,528 --> 00:16:43,860

didn't ever observe it or or when did

387

00:16:40,500 --> 00:16:47,308

the this interest in other planet Aurora

388

00:16:43,860 --> 00:16:49,318

start and the second question is do the

389

00:16:47,308 --> 00:16:52,679

colors on other planets tell you

390

00:16:49,318 --> 00:16:57,628

anything about the composition so I saw

391

00:16:52,679 --> 00:16:59,758

the first question we spoke since the

392

00:16:57,629 --> 00:17:01,889

beginning of that hang out about visible

393

00:16:59,759 --> 00:17:04,409

emission in the atmosphere starting with

394

00:17:01,889 --> 00:17:06,298

yes actually there are also our

395

00:17:04,409 --> 00:17:08,010

emissions which are produced above the

396

00:17:06,298 --> 00:17:10,828

atmosphere we quickly mention them at

397

00:17:08,009 --> 00:17:13,980

the beginning which are actually radio

398

00:17:10,828 --> 00:17:16,288

emission so atmospheric emissions are

399

00:17:13,980 --> 00:17:18,449

produced by we say the precipitating

400  
00:17:16,288 --> 00:17:20,788  
charged particles essentially electrons

401  
00:17:18,449 --> 00:17:22,380  
and these electrons when guided by

402  
00:17:20,788 --> 00:17:26,009  
magnetic field line down to the

403  
00:17:22,380 --> 00:17:28,049  
atmosphere have the possibility to do to

404  
00:17:26,009 --> 00:17:31,710  
drive residence and stability to produce

405  
00:17:28,048 --> 00:17:34,798  
radio waves so radio emissions are also

406  
00:17:31,710 --> 00:17:36,480  
of oral nature and they are found around

407  
00:17:34,798 --> 00:17:38,700  
all magnetized planets of the solar

408  
00:17:36,480 --> 00:17:42,360  
system so back to your question the

409  
00:17:38,700 --> 00:17:45,058  
first time we found or on another planet

410  
00:17:42,359 --> 00:17:47,219  
than Earth well thanks to radio

411  
00:17:45,058 --> 00:17:50,869  
observations from the ground we've read

412  
00:17:47,220 --> 00:17:53,610  
telescopes based in the US and

413  
00:17:50,869 --> 00:17:55,439  
discovering the data the chemistry

414  
00:17:53,609 --> 00:17:57,418  
condition of Jupiter and actually which

415  
00:17:55,440 --> 00:17:59,970  
was the first proof that Jupiter

416  
00:17:57,419 --> 00:18:04,530  
processes a magnetic an internal

417  
00:17:59,970 --> 00:18:06,839  
magnetic shield and then with the space

418  
00:18:04,529 --> 00:18:09,779  
exploration thanks to the Voyager

419  
00:18:06,839 --> 00:18:13,349  
spacecraft which explored the four giant

420  
00:18:09,779 --> 00:18:16,740  
planets in the night in the 80s mainly

421  
00:18:13,349 --> 00:18:19,949  
70s 80s we had the possibility to look

422  
00:18:16,740 --> 00:18:22,288  
Institute with small telescopes on board

423  
00:18:19,950 --> 00:18:24,509  
the Voyager spacecraft and in particular

424  
00:18:22,288 --> 00:18:27,720  
UV spectrometer which was able to

425  
00:18:24,509 --> 00:18:30,390  
identify overall emissions at all these

426  
00:18:27,720 --> 00:18:33,509  
planets or Jupiter satyam in order

427  
00:18:30,390 --> 00:18:35,100  
Uranus and Neptune all around before you

428

00:18:33,509 --> 00:18:37,169  
go any further I 20 up real quick say

429  
00:18:35,099 --> 00:18:39,000  
Scott's got a pretty picture up so that

430  
00:18:37,169 --> 00:18:42,799  
we can emphasize that what are we

431  
00:18:39,000 --> 00:18:46,319  
looking at here so this picture is a

432  
00:18:42,798 --> 00:18:49,288  
sort of a collage of UV observations

433  
00:18:46,319 --> 00:18:52,558  
acquired by the open space telescope for

434  
00:18:49,288 --> 00:18:55,819  
the three giant system which are those

435  
00:18:52,558 --> 00:18:58,619  
of Jupiter Saturn and Uranus and showing

436  
00:18:55,819 --> 00:19:01,740  
basically the emissions which can be

437  
00:18:58,619 --> 00:19:04,849  
seen in the UV window so on these on

438  
00:19:01,740 --> 00:19:07,288  
these figures you show the planets and

439  
00:19:04,849 --> 00:19:12,839  
sometimes the satellite that have been

440  
00:19:07,288 --> 00:19:15,298  
caught by the HST em as well and you see

441  
00:19:12,839 --> 00:19:18,808  
that there are different sort of

442  
00:19:15,298 --> 00:19:20,849

emissions the solar light is reflected

443

00:19:18,808 --> 00:19:23,609

generally by the atmosphere of these

444

00:19:20,849 --> 00:19:27,449

bodies so this is why the planet or

445

00:19:23,609 --> 00:19:30,959

satellites are bluish all over the

446

00:19:27,450 --> 00:19:33,480

surface and in addition to this you see

447

00:19:30,960 --> 00:19:35,069

bright emissions which are the aura we

448

00:19:33,480 --> 00:19:37,740

are speaking as since the beginning of

449

00:19:35,069 --> 00:19:39,569

this stock which are these powerful

450

00:19:37,740 --> 00:19:42,390

emission you see the rear white and

451

00:19:39,569 --> 00:19:44,519

which are very localized so we say at

452

00:19:42,390 --> 00:19:47,250

earth that these emissions are

453

00:19:44,519 --> 00:19:50,730

distributed along two main so-called

454

00:19:47,250 --> 00:19:52,859

oral ovals so say two circles centered

455

00:19:50,730 --> 00:19:55,079

around magnetic poles and you can see

456

00:19:52,859 --> 00:19:56,969

here that looking at the specific



457  
00:19:55,079 --> 00:20:00,058  
planets for instance Jupiter the

458  
00:19:56,970 --> 00:20:01,110  
situation is both similar you see an

459  
00:20:00,058 --> 00:20:03,240  
oval which is

460  
00:20:01,109 --> 00:20:05,729  
crescenta out on the sofa magnetic board

461  
00:20:03,240 --> 00:20:07,740  
here but also different the the

462  
00:20:05,730 --> 00:20:10,319  
phenology is much more complex and

463  
00:20:07,740 --> 00:20:12,589  
valuable than at F and this can be

464  
00:20:10,319 --> 00:20:14,970  
transposed to the other planets as well

465  
00:20:12,589 --> 00:20:17,939  
so noticing with this image here that I

466  
00:20:14,970 --> 00:20:20,210  
owe seems to have Aurora as well roll

467  
00:20:17,940 --> 00:20:25,110  
emissions is that what I'm seeing there

468  
00:20:20,210 --> 00:20:29,100  
in this image which one I owe the moon

469  
00:20:25,109 --> 00:20:31,798  
what is yes so I you is an example of

470  
00:20:29,099 --> 00:20:35,659  
aura that week which can be found on a

471  
00:20:31,798 --> 00:20:38,639  
satellite because we briefly say that

472  
00:20:35,660 --> 00:20:41,040  
such lights are produced when there is a

473  
00:20:38,640 --> 00:20:43,830  
beam of energetic particles which

474  
00:20:41,039 --> 00:20:47,389  
collide with a neutral medium say an

475  
00:20:43,829 --> 00:20:53,428  
atmosphere and so as these satellites

476  
00:20:47,390 --> 00:20:55,049  
say I Organa need or Europa possesses an

477  
00:20:53,429 --> 00:20:58,410  
exhaust fee or at least the surface

478  
00:20:55,048 --> 00:21:01,168  
where this can particle can with which

479  
00:20:58,410 --> 00:21:07,259  
this kind particle can collide these

480  
00:21:01,169 --> 00:21:09,259  
witnesses derive the arrival of beams of

481  
00:21:07,259 --> 00:21:13,980  
charged particles so these materialize

482  
00:21:09,259 --> 00:21:15,990  
arise arise of satellites hmm and so and

483  
00:21:13,980 --> 00:21:18,058  
tighten there right next to it looks

484  
00:21:15,990 --> 00:21:21,690  
pretty quiet be does that mean not so

485

00:21:18,058 --> 00:21:24,178  
much or what what is that Titan was put

486  
00:21:21,690 --> 00:21:25,919  
there because it was observed but nor or

487  
00:21:24,179 --> 00:21:29,190  
other missions where we are detected on

488  
00:21:25,919 --> 00:21:33,809  
that satellite because it's not very

489  
00:21:29,190 --> 00:21:37,259  
well coupled in the electrodynamic term

490  
00:21:33,808 --> 00:21:39,119  
to his planet contrary to iOS Jupiter

491  
00:21:37,259 --> 00:21:42,839  
and just to come back to the second

492  
00:21:39,119 --> 00:21:44,849  
question of Kerala what may we infer

493  
00:21:42,839 --> 00:21:47,308  
we've is emissions about the atmospheric

494  
00:21:44,849 --> 00:21:49,798  
compositions atmospheric composition of

495  
00:21:47,308 --> 00:21:53,129  
his bodies as for the atmosphere of

496  
00:21:49,798 --> 00:21:55,019  
giant planets Jupiter Saturn Uranus we

497  
00:21:53,130 --> 00:21:57,299  
know that the atmosphere is dominated by

498  
00:21:55,019 --> 00:21:59,190  
hydrogen XP sees so this has been shown

499  
00:21:57,298 --> 00:22:02,730

with a spectroscopic observations of

500

00:21:59,190 --> 00:22:06,919

other in particular that we are facing

501

00:22:02,730 --> 00:22:10,289

emissions oral emissions are reflecting

502

00:22:06,919 --> 00:22:12,480

H&H too many species so this is a

503

00:22:10,289 --> 00:22:14,700

diagnosis of the atmospheric composition

504

00:22:12,480 --> 00:22:17,509

as far i owe the situation

505

00:22:14,700 --> 00:22:22,470

quite differently Scott because I o is a

506

00:22:17,509 --> 00:22:25,109

emitting is possessing Nexus sphere

507

00:22:22,470 --> 00:22:27,240

which is made of different atmospheric

508

00:22:25,109 --> 00:22:30,750

species exhaust Eric species and may be

509

00:22:27,240 --> 00:22:32,549

dominated by oxygen so on the image of

510

00:22:30,750 --> 00:22:38,880

are you what you see the aura that you

511

00:22:32,549 --> 00:22:42,180

see are produced by oxygen so the UV

512

00:22:38,880 --> 00:22:44,700

window is able to do to pick up specific

513

00:22:42,180 --> 00:22:47,250

transitions which which can come from

514  
00:22:44,700 --> 00:22:50,730  
either hydrogen for the atmosphere giant

515  
00:22:47,250 --> 00:22:53,369  
planets either oxygen or the dioxygen

516  
00:22:50,730 --> 00:22:55,910  
for for their satellites so we all know

517  
00:22:53,369 --> 00:22:58,079  
that I was a pretty active place

518  
00:22:55,910 --> 00:22:59,700  
geologically and with you know lots of

519  
00:22:58,079 --> 00:23:00,899  
activity going on there and the reason

520  
00:22:59,700 --> 00:23:03,420  
that you're confident these are our

521  
00:23:00,900 --> 00:23:04,950  
rural emissions happens to be the fact

522  
00:23:03,420 --> 00:23:06,630  
that they're so bright in the UV then

523  
00:23:04,950 --> 00:23:09,059  
correct and not something else that

524  
00:23:06,630 --> 00:23:11,280  
might be going on with or without yes

525  
00:23:09,059 --> 00:23:13,919  
they are bright they are localized they

526  
00:23:11,279 --> 00:23:16,889  
are transient so these are properties of

527  
00:23:13,920 --> 00:23:19,800  
early missions this cannot be something

528  
00:23:16,890 --> 00:23:22,290  
due to the the reflected sunlight for

529  
00:23:19,799 --> 00:23:26,480  
instance because it would affect the

530  
00:23:22,289 --> 00:23:28,740  
world enlightened face on the satellite

531  
00:23:26,480 --> 00:23:30,240  
okay I have a really relate a really

532  
00:23:28,740 --> 00:23:33,240  
good related question from Patrick

533  
00:23:30,240 --> 00:23:35,009  
Calhoun on the Q&A app who is going do

534  
00:23:33,240 --> 00:23:37,710  
you think a planetary filter will ever

535  
00:23:35,009 --> 00:23:41,579  
be made some day for us to see the

536  
00:23:37,710 --> 00:23:43,950  
Aurora from Earth a planet that we

537  
00:23:41,579 --> 00:23:46,259  
feature yeah I guess I guess the

538  
00:23:43,950 --> 00:23:49,049  
question is should we see would we be

539  
00:23:46,259 --> 00:23:54,629  
able to observe planetary Aurora from

540  
00:23:49,049 --> 00:23:57,419  
Hubble of the earth I think this has

541  
00:23:54,630 --> 00:24:01,110  
been done not by over vetted by an over

542

00:23:57,420 --> 00:24:02,460  
x-ray telescope orbiting Earth pointing

543  
00:24:01,109 --> 00:24:05,729  
to the night side of the earth and

544  
00:24:02,460 --> 00:24:08,279  
tracking x-ray mission but I don't think

545  
00:24:05,730 --> 00:24:11,250  
about try to do that because of the risk

546  
00:24:08,279 --> 00:24:13,289  
to to point the Sun in the field of view

547  
00:24:11,250 --> 00:24:15,930  
and then to to damage the instruments

548  
00:24:13,289 --> 00:24:18,329  
but carol you may correct me now that's

549  
00:24:15,930 --> 00:24:20,850  
right we can't point at the earth and in

550  
00:24:18,329 --> 00:24:23,519  
fact when Hubble goes or as the Hubble

551  
00:24:20,849 --> 00:24:25,559  
goes around the earth we have to make

552  
00:24:23,519 --> 00:24:27,690  
sure we're not pointing towards it

553  
00:24:25,559 --> 00:24:28,168  
because it's too bright and so we can't

554  
00:24:27,690 --> 00:24:32,460  
make

555  
00:24:28,169 --> 00:24:34,710  
observations of the earth I think there

556  
00:24:32,460 --> 00:24:38,429

are also there may have been some earth

557

00:24:34,710 --> 00:24:40,940

looking you know like Landsat and GOI

558

00:24:38,429 --> 00:24:45,139

and some of those earth looking

559

00:24:40,940 --> 00:24:48,298

satellites certainly the astronauts saw

560

00:24:45,138 --> 00:24:51,748

Aurora for all the fish with a shovel

561

00:24:48,298 --> 00:24:53,908

Knight they took lots of pictures so

562

00:24:51,749 --> 00:24:58,048

that's a better platform that's a great

563

00:24:53,909 --> 00:24:59,970

platform initially but is really the

564

00:24:58,048 --> 00:25:02,579

sensitivity and the size of the

565

00:24:59,970 --> 00:25:06,210

telescope the primary mirror that the

566

00:25:02,579 --> 00:25:08,428

stsci team does not want to damage and

567

00:25:06,210 --> 00:25:12,210

you write that many spacecraft I've

568

00:25:08,429 --> 00:25:15,269

taken images of the observer from space

569

00:25:12,210 --> 00:25:17,608

and so imaging both arise on the day

570

00:25:15,269 --> 00:25:21,118

side and on the night side and you also



571  
00:25:17,608 --> 00:25:24,470  
write by pointing that the ISS team the

572  
00:25:21,118 --> 00:25:26,608  
astronauts onboard the ISS station are

573  
00:25:24,470 --> 00:25:29,009  
continuously taking photographs and

574  
00:25:26,608 --> 00:25:32,249  
making beautiful films that you may find

575  
00:25:29,009 --> 00:25:34,499  
on the internet and that show actually

576  
00:25:32,249 --> 00:25:37,440  
very well the dynamics of this emission

577  
00:25:34,499 --> 00:25:40,528  
when we are on the on the earth we can

578  
00:25:37,440 --> 00:25:42,899  
look at these emissions from very far

579  
00:25:40,528 --> 00:25:44,819  
actually and that's the same situation

580  
00:25:42,898 --> 00:25:46,738  
for a telescope which is orbiting the

581  
00:25:44,819 --> 00:25:49,470  
Earth very far but with the ISS station

582  
00:25:46,739 --> 00:25:51,889  
the auras are seen by the eye actually

583  
00:25:49,470 --> 00:25:55,470  
so the level of detail is really

584  
00:25:51,888 --> 00:25:57,959  
impressive yeah good question and the

585  
00:25:55,470 --> 00:26:01,079  
well I got page 2 for those that want to

586  
00:25:57,960 --> 00:26:03,058  
see the Aurora from space it's for the

587  
00:26:01,079 --> 00:26:05,759  
Gateway astronaut photography of Earth

588  
00:26:03,058 --> 00:26:07,858  
and swear i use when I've made some of

589  
00:26:05,759 --> 00:26:10,019  
my compilation videos I use a lot of the

590  
00:26:07,858 --> 00:26:11,668  
source material here which are from the

591  
00:26:10,019 --> 00:26:13,079  
time-lapse photography that are done by

592  
00:26:11,669 --> 00:26:16,278  
the astronauts from the International

593  
00:26:13,079 --> 00:26:18,480  
Space Station I'll put it into the

594  
00:26:16,278 --> 00:26:20,278  
Google+ event I'll tweet it out there

595  
00:26:18,480 --> 00:26:22,230  
but for those and actually i'll put in a

596  
00:26:20,278 --> 00:26:26,038  
comment on youtube too but it's e 0 l

597  
00:26:22,230 --> 00:26:27,778  
dot JSC nasa gov and you're you're able

598  
00:26:26,038 --> 00:26:29,970  
to go through and actually get all the

599

00:26:27,778 --> 00:26:32,429  
full resolution images if you want them

600  
00:26:29,970 --> 00:26:35,038  
or also see them in a movie file yeah

601  
00:26:32,429 --> 00:26:36,778  
the time racks the ISS is far are we one

602  
00:26:35,038 --> 00:26:38,669  
of the best spots to try and see some of

603  
00:26:36,778 --> 00:26:39,950  
these activities so that's that's good

604  
00:26:38,669 --> 00:26:42,110  
thanks God

605  
00:26:39,950 --> 00:26:44,210  
ok so we've we've basic what I want to

606  
00:26:42,109 --> 00:26:47,199  
know though Laurent is okay so you've

607  
00:26:44,210 --> 00:26:49,429  
been looking at these observe these uh

608  
00:26:47,200 --> 00:26:51,230  
Rory from all different planets and

609  
00:26:49,429 --> 00:26:53,778  
using the Hubble you've gotten gotten

610  
00:26:51,230 --> 00:26:55,610  
some good data what have been the

611  
00:26:53,778 --> 00:26:58,069  
greatest what's been your biggest

612  
00:26:55,609 --> 00:26:59,959  
surprise in observing has there been a

613  
00:26:58,069 --> 00:27:01,879

planet that was unusually more active

614

00:26:59,960 --> 00:27:03,350

than you thought brighter than you

615

00:27:01,880 --> 00:27:06,039

thought they have is anything really

616

00:27:03,349 --> 00:27:08,599

really surprised you in your research

617

00:27:06,038 --> 00:27:10,460

you mean myself for the community in

618

00:27:08,599 --> 00:27:12,648

general what way out amazing I guess

619

00:27:10,460 --> 00:27:14,808

both I guess both so I mean I like

620

00:27:12,648 --> 00:27:16,308

looking at these Rory what were you what

621

00:27:14,808 --> 00:27:19,220

were you expecting versus what did you

622

00:27:16,308 --> 00:27:22,700

find if we take the case of Jupiter for

623

00:27:19,220 --> 00:27:25,639

instance so Scott maybe you may may

624

00:27:22,700 --> 00:27:29,000

display the composite figure of Jupiter

625

00:27:25,638 --> 00:27:31,129

made made of other images taken in the

626

00:27:29,000 --> 00:27:37,398

UV and in the visible range you see

627

00:27:31,130 --> 00:27:40,809

these two ovals centered around magnetic

628  
00:27:37,398 --> 00:27:43,849  
poles right shut up now okay and when

629  
00:27:40,808 --> 00:27:48,019  
yet UV observers look at these images

630  
00:27:43,849 --> 00:27:50,658  
first they identified that stranger spot

631  
00:27:48,019 --> 00:27:53,000  
that you see both the novel in the

632  
00:27:50,659 --> 00:27:54,620  
southern hemisphere do see it's a quite

633  
00:27:53,000 --> 00:27:58,009  
a world of the main oval it's a bright

634  
00:27:54,619 --> 00:27:59,629  
spot with sort of the wake right is not

635  
00:27:58,009 --> 00:28:02,480  
bright right below the spirals on both

636  
00:27:59,630 --> 00:28:04,669  
sides a number oh yes that's on both on

637  
00:28:02,480 --> 00:28:07,700  
both on both sides and actually people

638  
00:28:04,669 --> 00:28:10,220  
then realize that this was this spot was

639  
00:28:07,700 --> 00:28:12,759  
related to the magnetic flux tube which

640  
00:28:10,220 --> 00:28:16,130  
was connecting to the satellite I oh and

641  
00:28:12,759 --> 00:28:19,940  
so that was a surprise let me say that

642  
00:28:16,130 --> 00:28:21,470  
again make sure hahaha so this magnetic

643  
00:28:19,940 --> 00:28:23,149  
flux tube the mat you said was the

644  
00:28:21,470 --> 00:28:26,298  
magnetic flux tube associated with I oh

645  
00:28:23,148 --> 00:28:28,369  
right exactly and so there are over

646  
00:28:26,298 --> 00:28:31,638  
sports which may be seen on the

647  
00:28:28,369 --> 00:28:34,609  
following picture if Scott can display

648  
00:28:31,638 --> 00:28:39,048  
it which are associated with over

649  
00:28:34,609 --> 00:28:41,240  
Galilean satellites a Jupiter so the

650  
00:28:39,048 --> 00:28:43,638  
fact that we get a spot at the footprint

651  
00:28:41,240 --> 00:28:45,440  
so we call it a footprint of a magnetic

652  
00:28:43,638 --> 00:28:48,048  
field connected to a satellite is

653  
00:28:45,440 --> 00:28:51,019  
sending us something and the most

654  
00:28:48,048 --> 00:28:53,028  
enthusiastic discovery was to realize

655  
00:28:51,019 --> 00:28:53,630  
that there was sort of a coupling

656

00:28:53,028 --> 00:28:56,150  
between

657  
00:28:53,630 --> 00:28:58,810  
satellite and the planets able to

658  
00:28:56,150 --> 00:29:02,210  
accelerate particle enough to produce

659  
00:28:58,809 --> 00:29:05,029  
such bright footprints at the foot of

660  
00:29:02,210 --> 00:29:07,069  
the field lines connecting satellite to

661  
00:29:05,029 --> 00:29:09,230  
the planets so this was a major

662  
00:29:07,069 --> 00:29:12,379  
discovery actually and when you look at

663  
00:29:09,230 --> 00:29:15,019  
at at least picture of Jupiter with the

664  
00:29:12,380 --> 00:29:16,910  
main oval and some specific polarization

665  
00:29:15,019 --> 00:29:18,829  
you clearly see different spots which

666  
00:29:16,910 --> 00:29:20,590  
are materially materializing the

667  
00:29:18,829 --> 00:29:23,599  
different Galilean satellites of Jupiter

668  
00:29:20,589 --> 00:29:26,269  
I'm in which is beside the scar and

669  
00:29:23,599 --> 00:29:28,659  
having a pregnant I'm trying to yes I

670  
00:29:26,269 --> 00:29:31,849

see it it says the main oval and it has

671

00:29:28,660 --> 00:29:35,360

yeah Scott has it up and it shows IO and

672

00:29:31,849 --> 00:29:37,789

Europa and Ganymede and since there are

673

00:29:35,359 --> 00:29:41,329

little dots that that then connect the

674

00:29:37,789 --> 00:29:42,920

two the tube line so so I mean what

675

00:29:41,329 --> 00:29:45,649

Laura is saying if i can put words in

676

00:29:42,920 --> 00:29:49,910

his mouth is that jupiter is an amazing

677

00:29:45,650 --> 00:29:52,100

environment because the you know some of

678

00:29:49,910 --> 00:29:54,830

those satellites those moons have

679

00:29:52,099 --> 00:29:57,529

atmospheres as well and and Jupiter

680

00:29:54,829 --> 00:30:02,629

really interacts with some of the main

681

00:29:57,529 --> 00:30:04,819

moons it's mains moons and so there's

682

00:30:02,630 --> 00:30:07,910

this communication that goes on between

683

00:30:04,819 --> 00:30:10,909

Jupiter and the moon's through these

684

00:30:07,910 --> 00:30:16,430

magnetic field lines and so they share



685  
00:30:10,910 --> 00:30:19,430  
this Aurora phenomenon exactly I'm sorry

686  
00:30:16,430 --> 00:30:22,519  
go ahead finish exactly and this

687  
00:30:19,430 --> 00:30:24,710  
connection is of electric nature because

688  
00:30:22,519 --> 00:30:27,980  
we have an exchange of charged particles

689  
00:30:24,710 --> 00:30:29,539  
so this means currents and just to

690  
00:30:27,980 --> 00:30:32,779  
finish with if we take that picture of

691  
00:30:29,539 --> 00:30:34,970  
Jupiter if we now exclude a satellite

692  
00:30:32,779 --> 00:30:36,950  
you see that you also add a manual mode

693  
00:30:34,970 --> 00:30:38,930  
gather with polar missions and all

694  
00:30:36,950 --> 00:30:42,620  
together we can say that when we look at

695  
00:30:38,930 --> 00:30:46,789  
the specific at orals emissions of a

696  
00:30:42,619 --> 00:30:50,469  
specific planet each part of this

697  
00:30:46,789 --> 00:30:53,599  
complex morphology says something to us

698  
00:30:50,470 --> 00:30:56,150  
in terms of magnetospheric physics I

699  
00:30:53,599 --> 00:30:57,949  
mean to produce this bright emission you

700  
00:30:56,150 --> 00:31:00,200  
need to have an active region somewhere

701  
00:30:57,950 --> 00:31:02,960  
in the magnetosphere and each bright

702  
00:31:00,200 --> 00:31:05,990  
spot our overalls or transient phenomena

703  
00:31:02,960 --> 00:31:07,360  
refer to something a commune transiently

704  
00:31:05,990 --> 00:31:11,900  
or not in the magnetosphere

705  
00:31:07,359 --> 00:31:15,109  
is there any relationship or connection

706  
00:31:11,900 --> 00:31:17,300  
between the size of the planet and the

707  
00:31:15,109 --> 00:31:19,419  
strength of these Aurora like does

708  
00:31:17,299 --> 00:31:23,000  
Jupiter have more powerful more bright

709  
00:31:19,420 --> 00:31:26,019  
Aurora them then other smaller planets

710  
00:31:23,000 --> 00:31:29,630  
or is that a is that related in any way

711  
00:31:26,019 --> 00:31:32,569  
yes Jupiter is the most powerful or a

712  
00:31:29,630 --> 00:31:34,010  
limiter of the solar system these

713

00:31:32,569 --> 00:31:36,950  
emissions that we see in these pictures

714  
00:31:34,009 --> 00:31:38,930  
are generally two to three orders of

715  
00:31:36,950 --> 00:31:41,569  
magnitude more intense in terms of

716  
00:31:38,930 --> 00:31:44,930  
emitted power with respect to these of

717  
00:31:41,569 --> 00:31:47,299  
the earth for instance Saturn is only

718  
00:31:44,930 --> 00:31:50,240  
one order of magnitude brighter with

719  
00:31:47,299 --> 00:31:51,769  
respect to the earth but then what is

720  
00:31:50,240 --> 00:31:55,789  
the reason what is the reason for his

721  
00:31:51,769 --> 00:31:58,369  
brightness you will ask right yes one

722  
00:31:55,789 --> 00:32:02,869  
guy yeah that was going to go okay and

723  
00:31:58,369 --> 00:32:04,459  
and we store under current understanding

724  
00:32:02,869 --> 00:32:06,769  
they are two main gentleman on that

725  
00:32:04,460 --> 00:32:09,200  
trigger the strength of this oral

726  
00:32:06,769 --> 00:32:11,269  
phenomena the first is the interaction

727  
00:32:09,200 --> 00:32:12,710

with the solar wind the interaction

728

00:32:11,269 --> 00:32:17,119  
between solar wind and the Earth's

729

00:32:12,710 --> 00:32:21,259  
magnetic field is the primary generator

730

00:32:17,119 --> 00:32:24,500  
for Earth's aura and Jupiter is the over

731

00:32:21,259 --> 00:32:26,210  
external case as Jupiter is not very

732

00:32:24,500 --> 00:32:28,700  
sensitive disallowing at all it

733

00:32:26,210 --> 00:32:30,410  
possesses very strong magnetic field so

734

00:32:28,700 --> 00:32:32,539  
is not very sensitive to Salah win and

735

00:32:30,410 --> 00:32:34,670  
these bright emissions essentially

736

00:32:32,539 --> 00:32:37,970  
internally triggered by the rapid

737

00:32:34,670 --> 00:32:40,190  
rotation of the planet so the solar wind

738

00:32:37,970 --> 00:32:42,880  
affect and effect at the planning degree

739

00:32:40,190 --> 00:32:44,690  
rotation are the two main drivers for

740

00:32:42,880 --> 00:32:46,880  
responsible for the brightness of

741

00:32:44,690 --> 00:32:48,980  
reservations so if you had a small

742  
00:32:46,880 --> 00:32:50,930  
planet that rotated very fast and had a

743  
00:32:48,980 --> 00:32:53,180  
very bright or very strong magnetic

744  
00:32:50,930 --> 00:32:55,910  
field for whatever reason you would get

745  
00:32:53,180 --> 00:32:57,970  
equally bright or at least very bright a

746  
00:32:55,910 --> 00:33:01,430  
role emissions from that so exactly

747  
00:32:57,970 --> 00:33:04,130  
exactly and we can we can quote the case

748  
00:33:01,430 --> 00:33:06,529  
of mercury which which has very weak

749  
00:33:04,130 --> 00:33:08,930  
magnetic field but which is located very

750  
00:33:06,529 --> 00:33:11,569  
close to the Sun and so where are the

751  
00:33:08,930 --> 00:33:14,269  
solar wind acts as the primary driver

752  
00:33:11,569 --> 00:33:17,689  
for oral emissions and as mercury is

753  
00:33:14,269 --> 00:33:19,940  
even weekly magnetized it displays all

754  
00:33:17,690 --> 00:33:21,409  
as well oh I didn't know that Wow well

755  
00:33:19,940 --> 00:33:24,528  
what about okay so let's talk about that

756  
00:33:21,409 --> 00:33:26,210  
Mars for example has as far as I know no

757  
00:33:24,528 --> 00:33:30,619  
magnetic field correct it doesn't have

758  
00:33:26,210 --> 00:33:33,409  
much of a dynamo at all uh so nothing

759  
00:33:30,619 --> 00:33:35,750  
right from Mars it would well as the

760  
00:33:33,409 --> 00:33:37,970  
question is open masters processor what

761  
00:33:35,750 --> 00:33:40,849  
we see what we call a crystal magnetic

762  
00:33:37,970 --> 00:33:43,600  
show so this is not Pamela a one

763  
00:33:40,849 --> 00:33:46,339  
magnetic field crystal I need to fill

764  
00:33:43,599 --> 00:33:48,648  
crystal which means that tourism right

765  
00:33:46,339 --> 00:33:51,109  
you make sure I understood because oh ok

766  
00:33:48,648 --> 00:33:53,058  
Chris right that's where certainly used

767  
00:33:51,109 --> 00:33:55,579  
in the past to possessed a permanent

768  
00:33:53,058 --> 00:33:57,980  
magnetic film like those of the other

769  
00:33:55,579 --> 00:34:02,329  
planets but it disappeared and we only

770

00:33:57,980 --> 00:34:04,730  
have traces of of it now which easier to

771  
00:34:02,329 --> 00:34:08,690  
call the crystal magnetic field and in

772  
00:34:04,730 --> 00:34:10,730  
the neighborhood of these traces of past

773  
00:34:08,690 --> 00:34:14,960  
magnetic field there have been some

774  
00:34:10,730 --> 00:34:17,449  
attempts to detect our emissions this is

775  
00:34:14,960 --> 00:34:20,000  
not abuse at all and then to finish with

776  
00:34:17,449 --> 00:34:22,759  
Venus Venus does not process any

777  
00:34:20,000 --> 00:34:24,800  
magnetic field at all so Venus this net

778  
00:34:22,760 --> 00:34:30,440  
force it process any permanent

779  
00:34:24,800 --> 00:34:31,579  
magnetosphere no all emissions I'm still

780  
00:34:30,440 --> 00:34:33,710  
trying to get my head around the church

781  
00:34:31,579 --> 00:34:37,149  
for magnetic field but i bet there is

782  
00:34:33,710 --> 00:34:39,139  
something there that's causing some some

783  
00:34:37,148 --> 00:34:40,789  
interaction in some way i should point

784  
00:34:39,139 --> 00:34:43,220

out that you have two small children in

785

00:34:40,789 --> 00:34:46,759

the background who are those just me oh

786

00:34:43,219 --> 00:34:50,480

that's hot yeah it's sorry the other

787

00:34:46,760 --> 00:34:53,480

picking me today absol yes god this is a

788

00:34:50,480 --> 00:34:56,769

great night Lake Forest yeah oh yeah

789

00:34:53,480 --> 00:35:00,380

it's true it is exact well okay so what

790

00:34:56,769 --> 00:35:04,519

the so youyou've you found that these

791

00:35:00,380 --> 00:35:06,108

are blue these satellite interactions

792

00:35:04,519 --> 00:35:08,210

were surprises or something you didn't

793

00:35:06,108 --> 00:35:10,009

expect to see when you began your

794

00:35:08,210 --> 00:35:11,389

research is there what's the future

795

00:35:10,010 --> 00:35:14,170

where are you going to head for here

796

00:35:11,389 --> 00:35:17,059

what's what's in store for you next so

797

00:35:14,170 --> 00:35:19,430

these satellites were an example of what

798

00:35:17,059 --> 00:35:23,059

surprised not only me but the community



799

00:35:19,429 --> 00:35:25,608  
when most recently I've worked with

800

00:35:23,059 --> 00:35:27,679  
adult Frank stable on the Uranus

801

00:35:25,608 --> 00:35:29,139  
magnetosphere which was very intriguing

802

00:35:27,679 --> 00:35:31,568  
because

803

00:35:29,139 --> 00:35:34,778  
Uranus oral oral emissions and

804

00:35:31,568 --> 00:35:37,538  
magnetosphere could only be investigated

805

00:35:34,778 --> 00:35:41,048  
once during the flyby of the planet by

806

00:35:37,539 --> 00:35:43,089  
the voyager 2 spacecraft in 1986 so we

807

00:35:41,048 --> 00:35:45,338  
could study that magnetosphere and all

808

00:35:43,088 --> 00:35:47,980  
our processes only with a few hours of

809

00:35:45,338 --> 00:35:50,798  
measurements acquired by Voyager 2 along

810

00:35:47,980 --> 00:35:53,949  
its trajectory but then we knew that

811

00:35:50,798 --> 00:35:56,880  
Uranus was magnetized and display or all

812

00:35:53,949 --> 00:35:58,689  
emissions and by calculating the

813  
00:35:56,880 --> 00:36:01,349  
theoretical brightness of these

814  
00:35:58,690 --> 00:36:04,389  
emissions we found that it shall be a

815  
00:36:01,349 --> 00:36:06,700  
chore feet the minimum threshold

816  
00:36:04,389 --> 00:36:10,629  
detection threshold of HST so we

817  
00:36:06,699 --> 00:36:14,858  
recently try to catch visa mission again

818  
00:36:10,630 --> 00:36:18,160  
and to do that instead of so this had

819  
00:36:14,858 --> 00:36:20,348  
been done twice in two decades as for

820  
00:36:18,159 --> 00:36:22,598  
Uranus but always with negative

821  
00:36:20,349 --> 00:36:24,369  
detections and instead of observing

822  
00:36:22,599 --> 00:36:26,048  
randomly this time we try to take

823  
00:36:24,369 --> 00:36:28,390  
benefit of a property we just mentioned

824  
00:36:26,048 --> 00:36:31,920  
which is the interaction between solar

825  
00:36:28,389 --> 00:36:34,088  
wind and the magnetic field of a planet

826  
00:36:31,920 --> 00:36:37,750  
because we mentioned this very briefly

827

00:36:34,088 --> 00:36:42,068  
but one property of the earth's and

828  
00:36:37,750 --> 00:36:43,869  
so the extra extrapolating this to

829  
00:36:42,068 --> 00:36:46,900  
Uranus and Neptune one property of this

830  
00:36:43,869 --> 00:36:49,778  
magnetosphere is to react to a strong

831  
00:36:46,900 --> 00:36:52,240  
compression of the solar wind reaching

832  
00:36:49,778 --> 00:36:56,500  
this planet so idea this is called as

833  
00:36:52,239 --> 00:36:58,739  
the substorm phenomena and with which

834  
00:36:56,500 --> 00:37:01,809  
gave rise to the state's waiver

835  
00:36:58,739 --> 00:37:03,518  
discipline when the compression rather

836  
00:37:01,809 --> 00:37:06,039  
earth the magnetosphere is compressed

837  
00:37:03,518 --> 00:37:08,139  
and then there is some of acceleration

838  
00:37:06,039 --> 00:37:11,500  
processes that are forced because of

839  
00:37:08,139 --> 00:37:16,118  
that compressed magnetosphere and this

840  
00:37:11,500 --> 00:37:20,608  
gives rise to very bright auroras right

841  
00:37:16,119 --> 00:37:23,588

and so to try to catch uranus or as we

842

00:37:20,608 --> 00:37:28,119

made the assumption that you're honest

843

00:37:23,588 --> 00:37:30,119

may react as as the earth does and so we

844

00:37:28,119 --> 00:37:32,650

observed during the path of a series of

845

00:37:30,119 --> 00:37:35,200

coronal mass ejection which we are

846

00:37:32,650 --> 00:37:37,750

propagating in the outer i use view

847

00:37:35,199 --> 00:37:40,538

along the along the planets until

848

00:37:37,750 --> 00:37:42,619

reaching uranus and then thanks to Adele

849

00:37:40,539 --> 00:37:44,480

we could observe at the right

850

00:37:42,619 --> 00:37:50,180

place at the right time and we got a

851

00:37:44,480 --> 00:37:53,119

detection and a picture of which I Scott

852

00:37:50,179 --> 00:37:55,159

may be able to show you right Harriet

853

00:37:53,119 --> 00:37:56,660

I'm really glad you talked about this

854

00:37:55,159 --> 00:37:59,298

because I was going to ask about this a

855

00:37:56,659 --> 00:38:01,098

bit of that cascading through the solar

856  
00:37:59,298 --> 00:38:02,719  
system and you being able to watch you

857  
00:38:01,099 --> 00:38:04,970  
know the mass ejection then comes to

858  
00:38:02,719 --> 00:38:07,788  
earth and etc so that's very interesting

859  
00:38:04,969 --> 00:38:12,199  
that you can kind of watch it propagate

860  
00:38:07,789 --> 00:38:14,028  
and then find really faint signature yes

861  
00:38:12,199 --> 00:38:16,879  
your friend and as far as I'm concerned

862  
00:38:14,028 --> 00:38:19,969  
that was one of the most surprising

863  
00:38:16,880 --> 00:38:23,240  
results we gotta thanks to movies novels

864  
00:38:19,969 --> 00:38:24,768  
measurements so coronal mass ejections

865  
00:38:23,239 --> 00:38:26,808  
are these magnetic eruptions from the

866  
00:38:24,768 --> 00:38:28,848  
Sun there they can be enormous and they

867  
00:38:26,809 --> 00:38:33,109  
they go out throughout the solar system

868  
00:38:28,849 --> 00:38:35,690  
with a lot of very primarily electrons

869  
00:38:33,108 --> 00:38:37,308  
and and things going along with it and

870  
00:38:35,690 --> 00:38:39,528  
when they hit these planets then it

871  
00:38:37,309 --> 00:38:40,640  
looks like you can see the signatures be

872  
00:38:39,528 --> 00:38:42,528  
able to compress you said the

873  
00:38:40,639 --> 00:38:45,980  
compression of the atmosphere and these

874  
00:38:42,528 --> 00:38:48,739  
are rural emissions net can we talk

875  
00:38:45,980 --> 00:38:50,449  
about Neptune for a minute I if I I may

876  
00:38:48,739 --> 00:38:52,338  
be screwing this up but i remember i

877  
00:38:50,449 --> 00:38:55,489  
think when Voyager 2 and by they were

878  
00:38:52,338 --> 00:38:57,588  
seeing these white bands on Neptune am I

879  
00:38:55,489 --> 00:38:59,630  
remembering correctly and they were

880  
00:38:57,588 --> 00:39:01,278  
these it was in the upper atmosphere of

881  
00:38:59,630 --> 00:39:05,358  
Neptune and I was wondering if those

882  
00:39:01,278 --> 00:39:08,539  
were a rural emissions or not well Jeff

883  
00:39:05,358 --> 00:39:11,298  
lie by nature to fly by Neptune in 1989

884

00:39:08,539 --> 00:39:13,190  
and as for the other planets it's UV

885  
00:39:11,298 --> 00:39:14,719  
spectrometer looked carefully at the

886  
00:39:13,190 --> 00:39:17,838  
other atmosphere of the planet and

887  
00:39:14,719 --> 00:39:20,298  
actually tentatively detected aura but

888  
00:39:17,838 --> 00:39:22,389  
they are they very faint and close to

889  
00:39:20,298 --> 00:39:25,730  
the detection threshold so even these

890  
00:39:22,389 --> 00:39:28,009  
claim that detection is not confirmed

891  
00:39:25,730 --> 00:39:29,960  
yet so I'm correct with what we did for

892  
00:39:28,009 --> 00:39:32,269  
your armies could certainly be reapplied

893  
00:39:29,960 --> 00:39:34,099  
for me Neptune except that an

894  
00:39:32,268 --> 00:39:38,028  
opportunist thieves much farther from

895  
00:39:34,099 --> 00:39:40,369  
the Sun and supposedly displays fainter

896  
00:39:38,028 --> 00:39:43,338  
all right so we are really at the limit

897  
00:39:40,369 --> 00:39:44,660  
of what other can do with the oral

898  
00:39:43,338 --> 00:39:46,969

emissions of the planets of the solar

899

00:39:44,659 --> 00:39:48,348

system okay Charles Bell has got a

900

00:39:46,969 --> 00:39:49,818

couple of really good questions for us

901

00:39:48,349 --> 00:39:52,609

on the queue and I am let me start with

902

00:39:49,818 --> 00:39:54,699

his first one he's asking have you

903

00:39:52,608 --> 00:39:57,279

studied the hydrogen

904

00:39:54,699 --> 00:40:01,059

via lyman-alpha emission from Venus

905

00:39:57,280 --> 00:40:05,859

using the Soho Swan images so host 1 i'm

906

00:40:01,059 --> 00:40:12,099

not sure what that is no i didn't and so

907

00:40:05,858 --> 00:40:16,000

what visa and how is named the charles

908

00:40:12,099 --> 00:40:19,500

though what's up what child is referring

909

00:40:16,000 --> 00:40:22,838

to is the fact that when venus is

910

00:40:19,500 --> 00:40:25,719

swamped into the solar wind it possesses

911

00:40:22,838 --> 00:40:29,199

a induced magnetosphere because the

912

00:40:25,719 --> 00:40:31,989

plasma are not pass through the planet



913  
00:40:29,199 --> 00:40:33,279  
and so it passes on the edges and it

914  
00:40:31,989 --> 00:40:36,250  
creates what we call it induced

915  
00:40:33,280 --> 00:40:38,109  
magnetosphere all come up and these

916  
00:40:36,250 --> 00:40:39,909  
types of magnetosphere has completely

917  
00:40:38,108 --> 00:40:42,190  
different properties as the permanent

918  
00:40:39,909 --> 00:40:44,039  
magnetosphere we just discussed and in

919  
00:40:42,190 --> 00:40:46,960  
particular it does not display any

920  
00:40:44,039 --> 00:40:49,838  
powerful plasma acceleration process

921  
00:40:46,960 --> 00:40:51,550  
which could trigger or other missions so

922  
00:40:49,838 --> 00:40:54,789  
i have not stood I'd Venus at all I

923  
00:40:51,550 --> 00:40:57,880  
would like two parts in some some

924  
00:40:54,789 --> 00:40:59,588  
occasion but because Venus is not a

925  
00:40:57,880 --> 00:41:02,740  
primary candidate for displaying these

926  
00:40:59,588 --> 00:41:05,289  
emissions okay good question Charles

927  
00:41:02,739 --> 00:41:07,088  
thank you uh Soho Swan I'm trying to

928  
00:41:05,289 --> 00:41:09,699  
think I thought I knew Soho I don't

929  
00:41:07,088 --> 00:41:12,190  
recall up I just went on there called

930  
00:41:09,699 --> 00:41:13,088  
that but he's got one more question let

931  
00:41:12,190 --> 00:41:15,068  
me just go ahead and get this out

932  
00:41:13,088 --> 00:41:18,608  
because this is also related have you

933  
00:41:15,068 --> 00:41:20,559  
used NASA Swift ultraviolet optical

934  
00:41:18,608 --> 00:41:24,519  
telescope for planetary aurori this is

935  
00:41:20,559 --> 00:41:27,789  
also from Charles so Swift is a plane

936  
00:41:24,519 --> 00:41:31,150  
right I'm not sure maybe calorie may

937  
00:41:27,789 --> 00:41:34,059  
help me I think that's this refers to a

938  
00:41:31,150 --> 00:41:39,369  
plane which possesses a telescope and

939  
00:41:34,059 --> 00:41:41,469  
able to observe at the highest altitudes

940  
00:41:39,369 --> 00:41:44,108  
of the Earth's atmosphere this is some

941

00:41:41,469 --> 00:41:48,549  
mixed mode question because Swift is an

942  
00:41:44,108 --> 00:41:52,719  
x-ray burster yeah a lie so I'm sure

943  
00:41:48,550 --> 00:41:57,490  
about a UV optical telescope above the

944  
00:41:52,719 --> 00:41:58,868  
atmosphere or other than Hubble so I'm

945  
00:41:57,489 --> 00:42:03,368  
not sure what we're referring to but

946  
00:41:58,869 --> 00:42:05,079  
Swift looks in the x-ray okay all right

947  
00:42:03,369 --> 00:42:07,210  
so I guess it doesn't sound like you've

948  
00:42:05,079 --> 00:42:08,410  
used it for that so I've question to

949  
00:42:07,210 --> 00:42:10,750  
thank you Charles

950  
00:42:08,409 --> 00:42:12,309  
um one more from Adam synergy who's got

951  
00:42:10,750 --> 00:42:14,980  
out who's got a good question he is he's

952  
00:42:12,309 --> 00:42:16,809  
also asking from the Q&A app he this is

953  
00:42:14,980 --> 00:42:19,480  
Adam asking would we see these bright

954  
00:42:16,809 --> 00:42:22,389  
emissions in a planet containing only

955  
00:42:19,480 --> 00:42:25,570

layers of metallic hydrogen and helium

956

00:42:22,389 --> 00:42:34,029

or is there is this more evidence of an

957

00:42:25,570 --> 00:42:35,710

iron core inside Jupiter well so I to

958

00:42:34,030 --> 00:42:37,630

answer repeat the question please could

959

00:42:35,710 --> 00:42:39,820

you really the bushes bright emissions

960

00:42:37,630 --> 00:42:42,160

in a planet containing only layers of

961

00:42:39,820 --> 00:42:43,750

metallic hydrogen and helium or is this

962

00:42:42,159 --> 00:42:47,409

more evidence of an iron core inside

963

00:42:43,750 --> 00:42:49,300

Jupiter but the fact is that these

964

00:42:47,409 --> 00:42:51,279

emissions are produced at the uppermost

965

00:42:49,300 --> 00:42:54,580

of the atmosphere and this does not

966

00:42:51,280 --> 00:42:56,410

consist of metallic hydrogen Metallica

967

00:42:54,579 --> 00:42:59,319

children is rather found at the core of

968

00:42:56,409 --> 00:43:01,569

the planet so this is a different layer

969

00:42:59,320 --> 00:43:03,670

of the planetary which cannot be

970  
00:43:01,570 --> 00:43:06,250  
impacted by these particles which are

971  
00:43:03,670 --> 00:43:10,329  
stopped by pressure much as much higher

972  
00:43:06,250 --> 00:43:13,570  
altitudes disinfectants yes right and so

973  
00:43:10,329 --> 00:43:15,389  
and so so let me comment is that the

974  
00:43:13,570 --> 00:43:17,890  
aurora phenomena the fact that it is

975  
00:43:15,389 --> 00:43:20,049  
related to the magnetic field one can

976  
00:43:17,889 --> 00:43:22,150  
look at each planet and say what is it

977  
00:43:20,050 --> 00:43:25,330  
that generates the magnetic field in the

978  
00:43:22,150 --> 00:43:29,170  
poor of that object and in the case the

979  
00:43:25,329 --> 00:43:30,730  
earth it is partly an iron core in the

980  
00:43:29,170 --> 00:43:33,340  
other planets especially the outer

981  
00:43:30,730 --> 00:43:37,179  
planets were so largely gaseous it may

982  
00:43:33,340 --> 00:43:39,910  
be a different phenomenon so on the

983  
00:43:37,179 --> 00:43:42,129  
magnetic field itself although Laurent

984  
00:43:39,909 --> 00:43:43,869  
can correct me because I'm not an expert

985  
00:43:42,130 --> 00:43:45,910  
but I think the existence of the

986  
00:43:43,869 --> 00:43:48,909  
magnetic field just says that there is

987  
00:43:45,909 --> 00:43:52,829  
something causing the matok field in the

988  
00:43:48,909 --> 00:43:56,739  
in the core it may not necessarily be

989  
00:43:52,829 --> 00:43:58,059  
iron you know ferrous or anything it's

990  
00:43:56,739 --> 00:44:01,869  
just something that is capable of

991  
00:43:58,059 --> 00:44:04,809  
generating a magnetic field haha go

992  
00:44:01,869 --> 00:44:08,230  
ahead Laurent sorry no just just to

993  
00:44:04,809 --> 00:44:11,829  
briefly mention that we think because we

994  
00:44:08,230 --> 00:44:14,349  
aren't sure we never we're able to go

995  
00:44:11,829 --> 00:44:16,840  
into the deep core of a planet but

996  
00:44:14,349 --> 00:44:19,239  
wishing that planetary magnetic fields

997  
00:44:16,840 --> 00:44:21,530  
are produced by a dynamo effect which is

998

00:44:19,239 --> 00:44:25,009  
driven by the motion of the

999  
00:44:21,530 --> 00:44:31,370  
some dense plasma so either a metallic

1000  
00:44:25,010 --> 00:44:34,570  
hydrogen or or or deeper of hours later

1001  
00:44:31,369 --> 00:44:38,750  
ions for instance in mercury which are

1002  
00:44:34,570 --> 00:44:40,610  
having some convection motion driven by

1003  
00:44:38,750 --> 00:44:46,010  
the rotation of the planet which then

1004  
00:44:40,610 --> 00:44:48,320  
give rise to a magnetic field ok so a

1005  
00:44:46,010 --> 00:44:50,630  
couple things here real quick to the

1006  
00:44:48,320 --> 00:44:53,800  
Swan instrument on soho is the solar

1007  
00:44:50,630 --> 00:44:55,820  
wind and invite pro-peace so that is a

1008  
00:44:53,800 --> 00:44:58,160  
collaboration with the finished

1009  
00:44:55,820 --> 00:45:00,650  
meteorological institute so that is an

1010  
00:44:58,159 --> 00:45:03,769  
instrument that's on soho and i have a

1011  
00:45:00,650 --> 00:45:07,550  
question from Twitter from summer ash

1012  
00:45:03,769 --> 00:45:10,219

was wondering with the interactions with

1013

00:45:07,550 --> 00:45:12,650

the natural satellites of jupiter on the

1014

00:45:10,219 --> 00:45:14,419

aurora is our moon interacting it all

1015

00:45:12,650 --> 00:45:18,769

with our Aurora that we're seeing on

1016

00:45:14,420 --> 00:45:22,700

earth so actually no our moon is not

1017

00:45:18,769 --> 00:45:25,009

interacting at all I mean electrodynamic

1018

00:45:22,699 --> 00:45:28,250

Ali speaking with the earth because the

1019

00:45:25,010 --> 00:45:30,620

the condition for satellite interact

1020

00:45:28,250 --> 00:45:34,070

with the planet is first that the

1021

00:45:30,619 --> 00:45:37,250

satellite moves into the magnetosphere

1022

00:45:34,070 --> 00:45:41,269

so it says permanently magnetic field

1023

00:45:37,250 --> 00:45:43,159

passing in front of it and second the

1024

00:45:41,269 --> 00:45:45,289

satellite shell process a conductive

1025

00:45:43,159 --> 00:45:48,409

exhaust years which is the condition for

1026

00:45:45,289 --> 00:45:50,929

this gigantic electrical currents to



1027  
00:45:48,409 --> 00:45:53,359  
close actually along the field lines and

1028  
00:45:50,929 --> 00:45:55,789  
then at the satellite so without a

1029  
00:45:53,360 --> 00:46:00,050  
conductive exhaust fear this electric

1030  
00:45:55,789 --> 00:46:03,349  
interruption cannot cannot give rise so

1031  
00:46:00,050 --> 00:46:06,680  
unfortunately a year the moon does not

1032  
00:46:03,349 --> 00:46:09,710  
process kuni lexus fear and actually

1033  
00:46:06,679 --> 00:46:12,309  
passes half of its time and out of the

1034  
00:46:09,710 --> 00:46:16,150  
magnetosphere so that an iu jupiter

1035  
00:46:12,309 --> 00:46:18,259  
interaction cannot be helped yourself

1036  
00:46:16,150 --> 00:46:19,910  
that's a great question thank you for

1037  
00:46:18,260 --> 00:46:21,770  
that charles also wants to point out

1038  
00:46:19,909 --> 00:46:24,710  
Charles Bell points out that the Swift

1039  
00:46:21,769 --> 00:46:29,509  
has both x-ray and UV optical telescopes

1040  
00:46:24,710 --> 00:46:31,460  
on board and apparently as you so i

1041  
00:46:29,510 --> 00:46:33,770  
don't i don't think they're being used

1042  
00:46:31,460 --> 00:46:34,670  
right now and in the way that orientis

1043  
00:46:33,769 --> 00:46:37,250  
is

1044  
00:46:34,670 --> 00:46:40,329  
is studying things so but thanks for

1045  
00:46:37,250 --> 00:46:43,960  
that Charles we appreciate it okay so

1046  
00:46:40,329 --> 00:46:47,360  
what is primarily to look at at galactic

1047  
00:46:43,960 --> 00:46:53,179  
burst worse things they don't in general

1048  
00:46:47,360 --> 00:46:58,340  
look at the solar system and in the case

1049  
00:46:53,179 --> 00:47:01,369  
of Soho Soho is specifically to look at

1050  
00:46:58,340 --> 00:47:03,800  
the Sun so it can tell you when there's

1051  
00:47:01,369 --> 00:47:05,059  
a burst or you know an emission from the

1052  
00:47:03,800 --> 00:47:07,670  
Sun but it's not going to turn around

1053  
00:47:05,059 --> 00:47:12,829  
and look at Jupiter in a response to

1054  
00:47:07,670 --> 00:47:14,269  
that right so one more go ahead you want

1055

00:47:12,829 --> 00:47:15,799  
to say something to that yeah I just

1056  
00:47:14,269 --> 00:47:17,360  
wanted to add that I retrieve the name

1057  
00:47:15,800 --> 00:47:19,640  
of the plane I was thinking to buy

1058  
00:47:17,360 --> 00:47:21,710  
you're discussing a swift which is

1059  
00:47:19,639 --> 00:47:27,079  
called a so she actually so she is a

1060  
00:47:21,710 --> 00:47:29,389  
parigi I Yes Man suit us plane Weaver

1061  
00:47:27,079 --> 00:47:31,369  
some telescopes on board which are able

1062  
00:47:29,389 --> 00:47:33,889  
to observe at very high altitudes and

1063  
00:47:31,369 --> 00:47:36,019  
which process is a UV telescope but it

1064  
00:47:33,889 --> 00:47:38,839  
is to a dick in the atmosphere to be

1065  
00:47:36,019 --> 00:47:42,829  
able to observe either F so where are

1066  
00:47:38,840 --> 00:47:44,530  
all the other planets here's this one

1067  
00:47:42,829 --> 00:47:49,069  
also from the Q&A app from Elodie

1068  
00:47:44,530 --> 00:47:51,019  
arguello and I think I'm gonna I hope I

1069  
00:47:49,070 --> 00:47:54,950

get this right is it unusual to have

1070

00:47:51,019 --> 00:47:57,590

Aurora's in the Sun and if not what

1071

00:47:54,949 --> 00:47:59,960

would be the consequences so i think i'm

1072

00:47:57,590 --> 00:48:04,250

reading that right can you have aurora

1073

00:47:59,960 --> 00:48:06,559

in the solar corona to gets nothing but

1074

00:48:04,250 --> 00:48:09,050

a charged particle but bath isn't it i

1075

00:48:06,559 --> 00:48:12,139

mean there's nothing but a plasma out

1076

00:48:09,050 --> 00:48:13,940

there certainly not the Aurora's that we

1077

00:48:12,139 --> 00:48:15,949

are used to see at the atmosphere

1078

00:48:13,940 --> 00:48:18,829

because the medium is not the same the

1079

00:48:15,949 --> 00:48:20,689

solar corona is very hot very charged

1080

00:48:18,829 --> 00:48:22,759

and this is completely different from

1081

00:48:20,690 --> 00:48:25,599

the neutral atmosphere we were dealing

1082

00:48:22,760 --> 00:48:28,190

with but so if we leave optical

1083

00:48:25,599 --> 00:48:31,969

emissions i think there are some

1084  
00:48:28,190 --> 00:48:34,309  
possibilities for the Sun to drive radio

1085  
00:48:31,969 --> 00:48:39,169  
emissions because radio emissions only

1086  
00:48:34,309 --> 00:48:41,570  
need tenuous plasma with energetic

1087  
00:48:39,170 --> 00:48:44,869  
electrons gyrating around magnetic field

1088  
00:48:41,570 --> 00:48:47,150  
lines so this can this can arrive around

1089  
00:48:44,869 --> 00:48:48,259  
magnetize planets but with may arrive as

1090  
00:48:47,150 --> 00:48:54,250  
well around the

1091  
00:48:48,260 --> 00:48:57,110  
and yeah so good the big the quran word

1092  
00:48:54,250 --> 00:49:01,820  
sorry i missed you the sound was good oh

1093  
00:48:57,110 --> 00:49:03,470  
you're dropping out I am oh so the the

1094  
00:49:01,820 --> 00:49:06,170  
environment of the solar corona is a

1095  
00:49:03,469 --> 00:49:08,269  
much different environment than the than

1096  
00:49:06,170 --> 00:49:10,369  
the than what we're talking about here

1097  
00:49:08,269 --> 00:49:13,219  
planetary atmospheres one when I was

1098  
00:49:10,369 --> 00:49:14,750  
working for one of the senior scientists

1099  
00:49:13,219 --> 00:49:16,489  
would ask love to ask the question how

1100  
00:49:14,750 --> 00:49:19,309  
can we have the Sun which is 5500

1101  
00:49:16,489 --> 00:49:22,339  
degrees Kelvin why could how can we have

1102  
00:49:19,309 --> 00:49:24,349  
a two million degree Kelvin two million

1103  
00:49:22,340 --> 00:49:26,120  
degree corona he used to love anti

1104  
00:49:24,349 --> 00:49:27,380  
question and and it's the answer is

1105  
00:49:26,119 --> 00:49:29,599  
rather intriguing I mean it's just a

1106  
00:49:27,380 --> 00:49:31,880  
very thin very dense a very thin

1107  
00:49:29,599 --> 00:49:34,519  
atmosphere however it's very very hot

1108  
00:49:31,880 --> 00:49:37,010  
and it's really a unique environment up

1109  
00:49:34,519 --> 00:49:38,539  
up in some but I don't think when you

1110  
00:49:37,010 --> 00:49:39,890  
think of the atmosphere of a son you

1111  
00:49:38,539 --> 00:49:41,449  
think of it as the same way as you would

1112

00:49:39,889 --> 00:49:44,150  
have planet so but that is a good

1113  
00:49:41,449 --> 00:49:45,889  
question though thank you very much okay

1114  
00:49:44,150 --> 00:49:50,170  
Carol let's get to one here that's been

1115  
00:49:45,889 --> 00:49:52,309  
sitting here this is from Christian

1116  
00:49:50,170 --> 00:49:55,579  
timati i think i'm pronouncing it right

1117  
00:49:52,309 --> 00:49:58,130  
what is the expected life of the Hubble

1118  
00:49:55,579 --> 00:50:02,389  
Space Telescope well it's a good

1119  
00:49:58,130 --> 00:50:05,300  
question so right now everything on

1120  
00:50:02,389 --> 00:50:07,009  
Hubble is operational everything that

1121  
00:50:05,300 --> 00:50:09,340  
was operational in the last servicing

1122  
00:50:07,010 --> 00:50:12,020  
mission in 2009 is in operation today

1123  
00:50:09,340 --> 00:50:13,610  
there is part one part of the advanced

1124  
00:50:12,019 --> 00:50:15,289  
camera for surveys which hasn't worked

1125  
00:50:13,610 --> 00:50:16,910  
and was unable to be fixed but

1126  
00:50:15,289 --> 00:50:19,009

everything else is working fine and that

1127

00:50:16,909 --> 00:50:22,279

includes not only instrumentation but

1128

00:50:19,010 --> 00:50:24,380

the batteries the computers the solar

1129

00:50:22,280 --> 00:50:26,240

cells and there are redundant systems as

1130

00:50:24,380 --> 00:50:28,670

well the pointing systems are redundant

1131

00:50:26,239 --> 00:50:31,069

so a few of the gyros have had some

1132

00:50:28,670 --> 00:50:33,320

difficulty and engineers watch the

1133

00:50:31,070 --> 00:50:36,559

performance of all of these instruments

1134

00:50:33,320 --> 00:50:38,630

as well as all of the satellite

1135

00:50:36,559 --> 00:50:41,179

components and as far as we can tell

1136

00:50:38,630 --> 00:50:43,820

except for a couple of the gyros that

1137

00:50:41,179 --> 00:50:45,980

have exhibited some noise and one

1138

00:50:43,820 --> 00:50:48,350

failure everything is operate as

1139

00:50:45,980 --> 00:50:52,969

operating fine so as long as it operates

1140

00:50:48,349 --> 00:50:56,059

fine it can last a long time and in



1141  
00:50:52,969 --> 00:50:58,699  
particular we are looking for now we're

1142  
00:50:56,059 --> 00:51:02,349  
on our 25th anniversary year we just

1143  
00:50:58,699 --> 00:51:06,409  
celebrated the 24th

1144  
00:51:02,349 --> 00:51:07,730  
we believe we astronomers believe and

1145  
00:51:06,409 --> 00:51:09,588  
some of the engineers believe it's going

1146  
00:51:07,730 --> 00:51:11,690  
to last until 2020 but it could last

1147  
00:51:09,588 --> 00:51:13,579  
well beyond that and the reason that

1148  
00:51:11,690 --> 00:51:15,650  
we're interested in having it last at

1149  
00:51:13,579 --> 00:51:17,779  
least until 2020 is because we would

1150  
00:51:15,650 --> 00:51:22,309  
like two years there's overlap with the

1151  
00:51:17,780 --> 00:51:26,510  
James Webb telescope which is launches

1152  
00:51:22,309 --> 00:51:29,000  
in 2018 but you know it's constantly

1153  
00:51:26,510 --> 00:51:31,250  
being monitored and it looks healthy so

1154  
00:51:29,000 --> 00:51:33,800  
it's like any other system you monitor

1155  
00:51:31,250 --> 00:51:36,619  
your car every day and you do the

1156  
00:51:33,800 --> 00:51:39,830  
readings and oil analysis and just check

1157  
00:51:36,619 --> 00:51:41,780  
your tire pressure and thanks Tim you

1158  
00:51:39,829 --> 00:51:43,400  
can be running we can't maintain it

1159  
00:51:41,780 --> 00:51:46,190  
anymore but it's going to run and run

1160  
00:51:43,400 --> 00:51:49,760  
and run until some major component fails

1161  
00:51:46,190 --> 00:51:52,338  
yeah if everything goes really well as

1162  
00:51:49,760 --> 00:51:54,290  
karolus is outlining all the stuff keeps

1163  
00:51:52,338 --> 00:51:57,739  
working then the limiting factor becomes

1164  
00:51:54,289 --> 00:51:59,809  
the orbit it's in and I think if i'm not

1165  
00:51:57,739 --> 00:52:03,319  
mistaken carol that is decide that will

1166  
00:51:59,809 --> 00:52:05,358  
be decided sometime around 20 28 it'll

1167  
00:52:03,320 --> 00:52:07,220  
start to have problems with its orbit

1168  
00:52:05,358 --> 00:52:11,539  
and we may have to take correct snack

1169

00:52:07,219 --> 00:52:13,489  
corrective action by then somehow so so

1170  
00:52:11,539 --> 00:52:18,289  
that's the ultimate the ultimate day

1171  
00:52:13,489 --> 00:52:22,368  
would be 2028 sometime even if it's all

1172  
00:52:18,289 --> 00:52:25,039  
working perfectly so but so if I mean

1173  
00:52:22,369 --> 00:52:27,140  
this telescope has exceeded expectations

1174  
00:52:25,039 --> 00:52:28,909  
at every turn from the very beginning on

1175  
00:52:27,139 --> 00:52:31,639  
up and I want to point out while we're

1176  
00:52:28,909 --> 00:52:33,529  
on this topic that Carolyn and Scott and

1177  
00:52:31,639 --> 00:52:34,909  
I are planning a history of Hubble hang

1178  
00:52:33,530 --> 00:52:36,320  
out sometime in September where we're

1179  
00:52:34,909 --> 00:52:38,750  
going to talk about Hubble nothing but

1180  
00:52:36,320 --> 00:52:40,880  
about what it's done just what it's been

1181  
00:52:38,750 --> 00:52:42,349  
through how we fixed it what it's what

1182  
00:52:40,880 --> 00:52:45,710  
it's gone through so look for that also

1183  
00:52:42,349 --> 00:52:47,900

in September I'm going to comment that

1184

00:52:45,710 --> 00:52:49,849

it's interesting because a lifetime of

1185

00:52:47,900 --> 00:52:52,550

Hubble is a little bit linked to what

1186

00:52:49,849 --> 00:52:55,160

Laura is talking about because with the

1187

00:52:52,550 --> 00:52:58,430

emissions from the Sun that can puff up

1188

00:52:55,159 --> 00:53:01,549

the atmosphere of the earth as well as

1189

00:52:58,429 --> 00:53:05,088

produce Aurora and depending on how the

1190

00:53:01,550 --> 00:53:09,050

atmosphere inflates or doesn't inflate

1191

00:53:05,088 --> 00:53:11,239

can produce drag if it puffs up enough

1192

00:53:09,050 --> 00:53:14,930

it produces drag on the telescope which

1193

00:53:11,239 --> 00:53:18,199

can then cause the orbit two

1194

00:53:14,929 --> 00:53:21,199

ok so the 20 28 I think is a

1195

00:53:18,199 --> 00:53:23,568

conservative estimate of the the

1196

00:53:21,199 --> 00:53:26,419

extension of the atmosphere and how much

1197

00:53:23,568 --> 00:53:28,068

it will influence the orbit of Hubble a

1198  
00:53:26,420 --> 00:53:29,269  
excellent point I mean it doesn't it

1199  
00:53:28,068 --> 00:53:30,739  
doesn't take into account all the

1200  
00:53:29,269 --> 00:53:32,539  
variations it can happen with space

1201  
00:53:30,739 --> 00:53:33,979  
weather and things like that people

1202  
00:53:32,539 --> 00:53:35,300  
forget that Hubble is while it is in

1203  
00:53:33,980 --> 00:53:36,949  
orbit it's still kind of in the

1204  
00:53:35,300 --> 00:53:38,780  
atmosphere of the earth so it is

1205  
00:53:36,949 --> 00:53:41,149  
affected by that a little bit and

1206  
00:53:38,780 --> 00:53:43,369  
Jacques darim on that also answers your

1207  
00:53:41,150 --> 00:53:44,660  
questions how long time remainder for

1208  
00:53:43,369 --> 00:53:46,369  
the mission for Hubble I think we've

1209  
00:53:44,659 --> 00:53:48,500  
pretty much covered that part there

1210  
00:53:46,369 --> 00:53:51,650  
ascot am I missing anything is that I do

1211  
00:53:48,500 --> 00:53:53,088  
have some from Twitter as well where are

1212  
00:53:51,650 --> 00:53:55,910  
you looking they're not using Hubble

1213  
00:53:53,088 --> 00:53:57,799  
hang out no we're communicating back and

1214  
00:53:55,909 --> 00:54:00,679  
forth with me now from a thread so

1215  
00:53:57,800 --> 00:54:01,970  
you're in charge of driving the internet

1216  
00:54:00,679 --> 00:54:04,029  
tell me you've known this for a while I

1217  
00:54:01,969 --> 00:54:06,799  
know that about now I should know better

1218  
00:54:04,030 --> 00:54:09,230  
so it's actually follow ups from summer

1219  
00:54:06,800 --> 00:54:12,050  
I was wondering is Callisto too far out

1220  
00:54:09,230 --> 00:54:15,440  
to interact in that way with Jupiter and

1221  
00:54:12,050 --> 00:54:20,000  
also are there any natural satellites

1222  
00:54:15,440 --> 00:54:23,690  
interacting with Saturn's Aurora so as

1223  
00:54:20,000 --> 00:54:26,568  
for Jupiter the the interaction between

1224  
00:54:23,690 --> 00:54:28,400  
Callisto and jupiter has been guests for

1225  
00:54:26,568 --> 00:54:31,338  
a long time ago and to my knowledge

1226

00:54:28,400 --> 00:54:34,730  
there has only been one possible

1227  
00:54:31,338 --> 00:54:38,000  
detection by a colleague of Boston which

1228  
00:54:34,730 --> 00:54:39,949  
is enriched yet so if any interaction

1229  
00:54:38,000 --> 00:54:42,230  
with at least shows that this shall be

1230  
00:54:39,949 --> 00:54:45,529  
very transient so calloused Oh shall

1231  
00:54:42,230 --> 00:54:46,760  
have a different type of interaction

1232  
00:54:45,530 --> 00:54:49,010  
with respect to the other Galilean

1233  
00:54:46,760 --> 00:54:54,200  
satellites probably or less conductive

1234  
00:54:49,010 --> 00:54:57,040  
exosphere and as for sat on the Cassini

1235  
00:54:54,199 --> 00:55:02,750  
mission recently discovered that

1236  
00:54:57,039 --> 00:55:05,058  
Enceladus is behaving as I yo does with

1237  
00:55:02,750 --> 00:55:07,309  
Jupiter and as Enceladus with Sachin

1238  
00:55:05,059 --> 00:55:09,769  
which means that Enceladus is producing

1239  
00:55:07,309 --> 00:55:13,430  
a footprint in oral emissions and you

1240  
00:55:09,769 --> 00:55:16,369

may see this on picture that was that

1241  
00:55:13,429 --> 00:55:20,899  
may harden hands Scott a wind generator

1242  
00:55:16,369 --> 00:55:23,210  
the second which displays actually a

1243  
00:55:20,900 --> 00:55:26,900  
picture of Sachin we did not speak about

1244  
00:55:23,210 --> 00:55:28,610  
Saturn yet I knew you see there these

1245  
00:55:26,900 --> 00:55:31,500  
models

1246  
00:55:28,610 --> 00:55:33,630  
pictures taken by a doll where you see

1247  
00:55:31,500 --> 00:55:35,940  
the the very valuable nature of Israel

1248  
00:55:33,630 --> 00:55:38,460  
emissions in particular the bright one

1249  
00:55:35,940 --> 00:55:40,950  
at the middle was produced by Halloween

1250  
00:55:38,460 --> 00:55:42,690  
compression reaching the planet so this

1251  
00:55:40,949 --> 00:55:47,460  
is an illustration and on the following

1252  
00:55:42,690 --> 00:55:51,079  
picture this is figured that was taken

1253  
00:55:47,460 --> 00:55:54,570  
by the Cassini UV spectrum major and

1254  
00:55:51,079 --> 00:56:02,159  
which with is actually a spot which is



1255  
00:55:54,570 --> 00:56:04,190  
linked to no not that one a spot which

1256  
00:56:02,159 --> 00:56:08,879  
which is named to Enceladus exactly as

1257  
00:56:04,190 --> 00:56:10,650  
as for i/o so and the fact interest with

1258  
00:56:08,880 --> 00:56:12,450  
cases under the main advantage of

1259  
00:56:10,650 --> 00:56:14,700  
Kissimmee was that it was that we could

1260  
00:56:12,449 --> 00:56:17,549  
we were able to get in situ measurements

1261  
00:56:14,699 --> 00:56:20,189  
and so so that's that picture you see

1262  
00:56:17,550 --> 00:56:22,620  
that when the spacecraft was crossing

1263  
00:56:20,190 --> 00:56:25,970  
the flics tube relating and salad

1264  
00:56:22,619 --> 00:56:29,929  
reduced to two sat on it was able to

1265  
00:56:25,969 --> 00:56:33,539  
acquire in situ measurements of plasma

1266  
00:56:29,929 --> 00:56:36,659  
traveling along these felines and then

1267  
00:56:33,539 --> 00:56:39,449  
remotely observe with a UV dress code

1268  
00:56:36,659 --> 00:56:41,399  
the the rural context under the surface

1269  
00:56:39,449 --> 00:56:44,609  
after on the atmosphere the planet and

1270  
00:56:41,400 --> 00:56:47,010  
so with these set of measurements we got

1271  
00:56:44,610 --> 00:56:49,880  
these two informations both remotely and

1272  
00:56:47,010 --> 00:56:52,740  
Institute and we could diagnose the full

1273  
00:56:49,880 --> 00:56:57,090  
electric current which is coupling and

1274  
00:56:52,739 --> 00:56:58,829  
said I just to its host planet alright

1275  
00:56:57,090 --> 00:57:00,960  
great thank you so we're running out of

1276  
00:56:58,829 --> 00:57:03,389  
time and I i wanna i want to thank

1277  
00:57:00,960 --> 00:57:05,159  
laurent lemme for joining us on talking

1278  
00:57:03,389 --> 00:57:07,199  
about planetary aurora he's from the

1279  
00:57:05,159 --> 00:57:08,609  
observatory of Paris they moved on Thank

1280  
00:57:07,199 --> 00:57:12,029  
You Laura and I appreciate your time

1281  
00:57:08,610 --> 00:57:13,400  
today yeah so before and before i go i

1282  
00:57:12,030 --> 00:57:19,110  
just want to i want to highlight one

1283

00:57:13,400 --> 00:57:21,539  
comment from YouTube that is say this is

1284  
00:57:19,110 --> 00:57:23,220  
from George Lloyd who goes hi Tony

1285  
00:57:21,539 --> 00:57:24,420  
Carolyn Scott I'm a subscriber people

1286  
00:57:23,219 --> 00:57:25,919  
strana me space fan news and have just

1287  
00:57:24,420 --> 00:57:27,809  
stumbled onto this channel I was

1288  
00:57:25,920 --> 00:57:30,420  
wondering how do I find out when other

1289  
00:57:27,809 --> 00:57:31,949  
live hangouts happen and reason I wanted

1290  
00:57:30,420 --> 00:57:33,809  
to highlight that is he owes I never

1291  
00:57:31,949 --> 00:57:36,179  
know when they're on and would maybe

1292  
00:57:33,809 --> 00:57:38,840  
like to ask a question live well Lloyd

1293  
00:57:36,179 --> 00:57:40,889  
the best way to find out is to is to

1294  
00:57:38,840 --> 00:57:42,059  
subscribe to this channel which is your

1295  
00:57:40,889 --> 00:57:44,579  
first step you'll get that note

1296  
00:57:42,059 --> 00:57:46,380  
vacation when it goes live we are if you

1297  
00:57:44,579 --> 00:57:48,449

also follow Hubble telescope and deep

1298

00:57:46,380 --> 00:57:50,309  
astronomy and scientific Scott on

1299

00:57:48,449 --> 00:57:52,500  
Twitter you'll be able to get what we

1300

00:57:50,309 --> 00:57:55,009  
are constantly letting people know and

1301

00:57:52,500 --> 00:57:59,159  
finally I'm shut up I'm always tweeting

1302

00:57:55,010 --> 00:58:00,600  
boy oh and so the so that's that's

1303

00:57:59,159 --> 00:58:03,509  
another great way to find out about when

1304

00:58:00,599 --> 00:58:04,949  
we're having these also Carol Scott and

1305

00:58:03,510 --> 00:58:07,020  
I are being very you know we're working

1306

00:58:04,949 --> 00:58:08,250  
on a schedule that is that is we're

1307

00:58:07,019 --> 00:58:10,619  
going to be doing these for the most

1308

00:58:08,250 --> 00:58:12,840  
part every single thursday at three pm

1309

00:58:10,619 --> 00:58:16,980  
eastern witch in the UK is seven o'clock

1310

00:58:12,840 --> 00:58:19,079  
your time so I so that's the best way to

1311

00:58:16,980 --> 00:58:21,510  
find out whether another thing I'll

1312  
00:58:19,079 --> 00:58:23,610  
mention if you google Hubble hangouts

1313  
00:58:21,510 --> 00:58:27,000  
you will find the web page that often

1314  
00:58:23,610 --> 00:58:28,559  
has what the next topic is yes we might

1315  
00:58:27,000 --> 00:58:30,570  
take a little vacation at the end of

1316  
00:58:28,559 --> 00:58:32,599  
august but mostly it'll be every

1317  
00:58:30,570 --> 00:58:35,430  
thursday at three unless our guest

1318  
00:58:32,599 --> 00:58:37,230  
absolutely cannot be with us at that

1319  
00:58:35,429 --> 00:58:40,230  
time and then we'll reschedule it but we

1320  
00:58:37,230 --> 00:58:42,210  
are trying about equations I know you

1321  
00:58:40,230 --> 00:58:50,190  
are not I didn't say anything about you

1322  
00:58:42,210 --> 00:58:53,220  
that's right so okay so that's it for

1323  
00:58:50,190 --> 00:58:55,050  
this week's folks next week we are we

1324  
00:58:53,219 --> 00:58:57,179  
are going to be having a hang out with

1325  
00:58:55,050 --> 00:58:59,700  
some of the people with the Institute on

1326  
00:58:57,179 --> 00:59:01,559  
the process of decide we're going to

1327  
00:58:59,699 --> 00:59:03,389  
talk about how do you get to use Hubble

1328  
00:59:01,559 --> 00:59:05,009  
what's it like what do you got to go

1329  
00:59:03,389 --> 00:59:07,859  
through to get Hubble time Lauren knows

1330  
00:59:05,010 --> 00:59:09,750  
because he's had to go through it up

1331  
00:59:07,860 --> 00:59:10,980  
with members of the time allocation

1332  
00:59:09,750 --> 00:59:13,769  
committee and we're going to talk about

1333  
00:59:10,980 --> 00:59:16,980  
how one goes about getting Hubble time

1334  
00:59:13,769 --> 00:59:18,750  
how what how was it decided what Hubble

1335  
00:59:16,980 --> 00:59:20,039  
looks at one of the things that I like

1336  
00:59:18,750 --> 00:59:22,019  
you know people I think have a little

1337  
00:59:20,039 --> 00:59:23,969  
misconception of what hubble hubble is

1338  
00:59:22,019 --> 00:59:25,469  
about as general purpose of telescope as

1339  
00:59:23,969 --> 00:59:28,049  
you're going to find in space but it was

1340

00:59:25,469 --> 00:59:30,509  
really designed to look for dim warm

1341  
00:59:28,050 --> 00:59:32,880  
things and so very very dim things or

1342  
00:59:30,510 --> 00:59:33,810  
what it what it what it excels at so

1343  
00:59:32,880 --> 00:59:36,720  
that's what we're going to be talking

1344  
00:59:33,809 --> 00:59:39,150  
about that next week on behalf of carol

1345  
00:59:36,719 --> 00:59:41,039  
christian scott lewis and lord dr.

1346  
00:59:39,150 --> 00:59:43,440  
lauren le'me i would like to thank you

1347  
00:59:41,039 --> 00:59:49,190  
all for watching and as always keep

1348  
00:59:43,440 --> 00:59:49,190  
looking up thank you overnight