

1
00:00:06,589 --> 00:00:10,650
hello everybody and welcome to this

2
00:00:08,730 --> 00:00:11,759
week's Hubble hangout my name is Tony

3
00:00:10,650 --> 00:00:13,919
Darnell I work at the Space Telescope

4
00:00:11,759 --> 00:00:16,410
Science Institute and this week we've

5
00:00:13,919 --> 00:00:17,910
got another awesome hangout plan for you

6
00:00:16,410 --> 00:00:20,010
what else would we have we always have

7
00:00:17,910 --> 00:00:21,629
awesome hangouts this week we're going

8
00:00:20,010 --> 00:00:25,320
to be talking we have members of the of

9
00:00:21,629 --> 00:00:27,000
NASA's Dawn mission a fatal on hand as

10
00:00:25,320 --> 00:00:30,028
well as the Hubble Space Telescope to

11
00:00:27,000 --> 00:00:33,210
talk about minor planets and asteroids

12
00:00:30,028 --> 00:00:35,039
in particular we've got the NASA Dawn

13
00:00:33,210 --> 00:00:38,219
mission is currently on route to reach

14
00:00:35,039 --> 00:00:39,600
the Minor Planet series early next year

15
00:00:38,219 --> 00:00:41,429
and we're going to get an update about

16
00:00:39,600 --> 00:00:44,010
what's going on some of the science

17
00:00:41,429 --> 00:00:47,308
goals that the team hope to learn as

18
00:00:44,009 --> 00:00:49,920
well as how Hubble was a played a role

19
00:00:47,308 --> 00:00:52,049
in some of these observations as well as

20
00:00:49,920 --> 00:00:54,719
so and some of the science that they're

21
00:00:52,049 --> 00:00:58,259
hoping to get done from this mission

22
00:00:54,719 --> 00:01:00,629
about before I get to the introductions

23
00:00:58,259 --> 00:01:02,820
I want to remind you that we on the

24
00:01:00,628 --> 00:01:06,000
event page of this of this event on

25
00:01:02,820 --> 00:01:09,629
Google+ we have links to Jason Keller

26
00:01:06,000 --> 00:01:11,849
eyes academic minute we would devote

27
00:01:09,629 --> 00:01:13,319
incluso Zahn on Friday we hope you'll

28
00:01:11,849 --> 00:01:16,019
take some time out to click on the link

29

00:01:13,319 --> 00:01:17,758
and if you liked his academic minute he

30
00:01:16,019 --> 00:01:20,489
is up for a listeners Choice Award and

31
00:01:17,759 --> 00:01:22,590
he's the subject of his academic minute

32
00:01:20,489 --> 00:01:24,118
was exploring exoplanets so I hope

33
00:01:22,590 --> 00:01:25,829
you'll take a minute and go there and

34
00:01:24,118 --> 00:01:28,618
vote it would be would be a great show

35
00:01:25,829 --> 00:01:31,109
of support for both the Institute Jason

36
00:01:28,618 --> 00:01:36,739
Kelly and JWST so please do that and

37
00:01:31,109 --> 00:01:39,420
Keller is a really nice guy too so guy

38
00:01:36,739 --> 00:01:43,109
yeah I definitely recommend voting for

39
00:01:39,420 --> 00:01:46,379
him right okay so with me today to

40
00:01:43,109 --> 00:01:48,478
discuss all this fun stuff is dr. John

41
00:01:46,379 --> 00:01:50,310
yang Lee he's been with many he's been

42
00:01:48,478 --> 00:01:52,228
in many hangouts with us he's talked to

43
00:01:50,310 --> 00:01:54,560

us about comets and today he's here to

44

00:01:52,228 --> 00:01:58,049

talk about minor planets hi John yang

45

00:01:54,560 --> 00:02:02,399

also with us is is max Mutchler he is

46

00:01:58,049 --> 00:02:04,680

our Hubble data extraordinaire and he

47

00:02:02,399 --> 00:02:06,149

handles all the Hubble data but my

48

00:02:04,680 --> 00:02:08,849

colleague at the Space Telescope Science

49

00:02:06,149 --> 00:02:11,098

Institute where they are enjoying lots

50

00:02:08,848 --> 00:02:13,949

of snow and you can see it in the

51

00:02:11,098 --> 00:02:18,719

background hi max and also

52

00:02:13,949 --> 00:02:20,818

Carrie beam from the from the NASA dawn

53

00:02:18,719 --> 00:02:23,009

mission she's at planetary Kari hi Kari

54

00:02:20,818 --> 00:02:23,519

and welcome to our hangout before we get

55

00:02:23,009 --> 00:02:26,459

started

56

00:02:23,520 --> 00:02:27,959

Scott yes can you tell everybody how

57

00:02:26,459 --> 00:02:31,500

they can interact with us you're driving

58
00:02:27,959 --> 00:02:34,800
the internet on assignment I'm okay I'm

59
00:02:31,500 --> 00:02:37,650
driving the Internet so yeah we are here

60
00:02:34,800 --> 00:02:40,620
live at NASA's Jet Propulsion Laboratory

61
00:02:37,650 --> 00:02:42,330
if you want to interact with us you can

62
00:02:40,620 --> 00:02:44,789
do so on Twitter using the hashtag

63
00:02:42,330 --> 00:02:47,520
Hubbell Hangouts you can also leave

64
00:02:44,789 --> 00:02:49,590
comments on the Google+ event page we

65
00:02:47,520 --> 00:02:51,780
will be checking those there using the

66
00:02:49,590 --> 00:02:54,209
Q&A app which is available on Google+

67
00:02:51,780 --> 00:02:55,680
and YouTube so on the bottom left-hand

68
00:02:54,209 --> 00:02:57,930
side as you're watching this no matter

69
00:02:55,680 --> 00:02:59,670
where it's at where it's embedded you'll

70
00:02:57,930 --> 00:03:02,040
be able to pop open and you can ask

71
00:02:59,669 --> 00:03:05,789
those questions and will allow us to

72
00:03:02,039 --> 00:03:08,400
answer them on air and then also there

73
00:03:05,789 --> 00:03:10,709
are the comment sections on YouTube so

74
00:03:08,400 --> 00:03:12,629
we'll be monitoring all of those because

75
00:03:10,709 --> 00:03:15,360
we love being able to answer your

76
00:03:12,629 --> 00:03:18,449
questions that are relevant to the topic

77
00:03:15,360 --> 00:03:21,360
oh you only want relevant questions now

78
00:03:18,449 --> 00:03:23,189
now relevant questions but if you have

79
00:03:21,360 --> 00:03:25,560
ideas for future hangouts please let us

80
00:03:23,189 --> 00:03:28,769
know there too because we love getting

81
00:03:25,560 --> 00:03:30,239
new ideas for future hangouts and we

82
00:03:28,769 --> 00:03:31,920
also are remiss when we we've always

83
00:03:30,239 --> 00:03:33,000
forget to do this but please if you want

84
00:03:31,919 --> 00:03:36,119
to learn more about these Hubble

85
00:03:33,000 --> 00:03:39,000
hangouts subscribe to our YouTube

86

00:03:36,120 --> 00:03:40,650
channel youtube.com slash hubble site

87
00:03:39,000 --> 00:03:42,659
channel and you will find out all about

88
00:03:40,650 --> 00:03:43,829
these upcoming events every single week

89
00:03:42,659 --> 00:03:46,139
we have them every Thursday although

90
00:03:43,829 --> 00:03:47,430
today we're doing a little bit early so

91
00:03:46,139 --> 00:03:51,029
let's get started

92
00:03:47,430 --> 00:03:53,640
let me start with you Kari can you what

93
00:03:51,030 --> 00:03:56,430
is dawn what's it hoping to do where is

94
00:03:53,639 --> 00:03:59,599
it going and what's its current status

95
00:03:56,430 --> 00:04:02,040
in that order I'm just kidding

96
00:03:59,599 --> 00:04:05,669
to help me out I'm actually going to

97
00:04:02,039 --> 00:04:08,789
call in dawn I have a nice 25 scale

98
00:04:05,669 --> 00:04:11,879
model here and so this is what our

99
00:04:08,789 --> 00:04:15,780
spacecraft looks like and so and I'm

100
00:04:11,879 --> 00:04:19,259

taking it with me by the way so we

101

00:04:15,780 --> 00:04:22,709

launched in 2007 and we flew by Mars in

102

00:04:19,259 --> 00:04:26,370

2009 and then we got to the asteroid

103

00:04:22,709 --> 00:04:27,689

Vesta in 2011 we left in 2012 and

104

00:04:26,370 --> 00:04:29,459

since then we've been cruising on our

105

00:04:27,689 --> 00:04:32,759

way to Ceres and now we are knocking on

106

00:04:29,459 --> 00:04:34,500

Ceres doorsteps and so we are hoping to

107

00:04:32,759 --> 00:04:36,120

use all of the lovely instruments up

108

00:04:34,500 --> 00:04:38,339

here on the top of the spacecraft to

109

00:04:36,120 --> 00:04:42,180

unlock Ceres secret

110

00:04:38,339 --> 00:04:43,978

we will not arrive at Ceres a rifle is

111

00:04:42,180 --> 00:04:45,810

somewhat of a complicated question for

112

00:04:43,978 --> 00:04:48,000

us because we have a ion propulsion

113

00:04:45,810 --> 00:04:50,129

system and so our dates can shift a

114

00:04:48,000 --> 00:04:52,168

little bit and we're a bit more flexible

115
00:04:50,129 --> 00:04:55,589
than normal mission using chemical

116
00:04:52,168 --> 00:05:02,668
propulsion so you got to tell us what

117
00:04:55,589 --> 00:05:05,009
ion drives are now so actually you can

118
00:05:02,668 --> 00:05:07,049
see one of them here we have three of

119
00:05:05,009 --> 00:05:08,789
them on our spacecraft and I mean it's

120
00:05:07,050 --> 00:05:10,290
totally a sci-fi concept if you think of

121
00:05:08,790 --> 00:05:12,300
Thai fighters from Star because it's in

122
00:05:10,290 --> 00:05:13,410
four twin ion engines and we do them

123
00:05:12,300 --> 00:05:16,530
better at one better because we have

124
00:05:13,410 --> 00:05:18,600
three so the and you can aim better than

125
00:05:16,529 --> 00:05:23,509
Tie Fighters do as well we know how

126
00:05:18,600 --> 00:05:27,000
portable Thai fighters are aiming yes so

127
00:05:23,509 --> 00:05:28,918
use these ion propulsion to move us

128
00:05:27,000 --> 00:05:31,379
around the solar system and it's a very

129
00:05:28,918 --> 00:05:33,538
like graceful slow movement you know

130
00:05:31,379 --> 00:05:35,519
chemical propulsion you fly there as

131
00:05:33,538 --> 00:05:36,629
fast as you can you slam on the brakes

132
00:05:35,519 --> 00:05:38,129
whereas this we're just kind of like

133
00:05:36,629 --> 00:05:40,680
slowly dancing through the solar system

134
00:05:38,129 --> 00:05:42,839
matching the speeds of the bodies we're

135
00:05:40,680 --> 00:05:45,810
trying to visit so it's pretty

136
00:05:42,839 --> 00:05:47,399
interesting the kind of difference and

137
00:05:45,810 --> 00:05:48,750
timescales and the way that we operate

138
00:05:47,399 --> 00:05:53,399
the spacecraft compared to other

139
00:05:48,750 --> 00:05:55,529
missions and so using this we actually

140
00:05:53,399 --> 00:05:59,069
start our series sequences on December

141
00:05:55,529 --> 00:06:01,859
26 so just a couple weeks from now

142
00:05:59,069 --> 00:06:04,589
we'll take our first set of optical

143

00:06:01,860 --> 00:06:06,509
navigation photos in the middle of

144
00:06:04,589 --> 00:06:08,459
January and we finally beat Hubble

145
00:06:06,509 --> 00:06:11,129
resolution at the end of January on

146
00:06:08,459 --> 00:06:14,788
January 25th where we will get one point

147
00:06:11,129 --> 00:06:16,228
four times Hubble resolution so we're

148
00:06:14,788 --> 00:06:19,560
looking for it but no one's counting

149
00:06:16,228 --> 00:06:20,788
over here yeah that's it's an important

150
00:06:19,560 --> 00:06:21,870
date we're going to come back to that in

151
00:06:20,788 --> 00:06:23,699
just a minute but right now I'm giving

152
00:06:21,870 --> 00:06:27,180
you I'm showing a quick overview of the

153
00:06:23,699 --> 00:06:28,918
of the the path that Dawn has gone

154
00:06:27,180 --> 00:06:32,550
through since it launched in September

155
00:06:28,918 --> 00:06:33,060
oh seven and as Kari said so you're

156
00:06:32,550 --> 00:06:35,400
awesome

157
00:06:33,060 --> 00:06:37,379

it's got earth and dawn as they are

158

00:06:35,399 --> 00:06:40,109

right now and you'll see it's almost a

159

00:06:37,379 --> 00:06:42,149

straight line between earth and dawn

160

00:06:40,110 --> 00:06:43,949

and so right now we are in what's called

161

00:06:42,149 --> 00:06:45,959

solar conjunction and that means we

162

00:06:43,949 --> 00:06:47,399

can't talk to the spacecraft as nicely

163

00:06:45,959 --> 00:06:50,099

because the Sun kind of gets in the way

164

00:06:47,399 --> 00:06:54,479

and it's noisy but it only lasts a few

165

00:06:50,100 --> 00:06:58,170

days and we in a couple days we'll hear

166

00:06:54,480 --> 00:07:02,009

from it again so so the so the Sun the

167

00:06:58,170 --> 00:07:05,810

the earth and Ceres are all in kind of a

168

00:07:02,009 --> 00:07:07,889

line right now okay and that's and

169

00:07:05,810 --> 00:07:10,439

that's not an omen

170

00:07:07,889 --> 00:07:15,209

don't worry YouTube commenters it's

171

00:07:10,439 --> 00:07:17,040

nothing really you sure because you know

172
00:07:15,209 --> 00:07:18,109
these are lion-o portents of things to

173
00:07:17,040 --> 00:07:20,430
come

174
00:07:18,110 --> 00:07:22,410
well good but it is preventing this

175
00:07:20,430 --> 00:07:23,759
alignment is preventing you from really

176
00:07:22,410 --> 00:07:26,040
communicating with spacecraft though

177
00:07:23,759 --> 00:07:28,889
right yeah we can hear from it a little

178
00:07:26,040 --> 00:07:31,230
bit but we don't have a really good

179
00:07:28,889 --> 00:07:32,669
connection with the spacecraft it's kind

180
00:07:31,230 --> 00:07:35,640
of like there's a lot of interference on

181
00:07:32,670 --> 00:07:38,340
the line so but just in a couple days

182
00:07:35,639 --> 00:07:41,069
we'll be far enough away from the Sun

183
00:07:38,339 --> 00:07:42,599
that it won't be a problem so because of

184
00:07:41,069 --> 00:07:44,730
the ion drive this thing it's been at it

185
00:07:42,600 --> 00:07:46,620
for a while it's been up in space and

186
00:07:44,730 --> 00:07:49,379
one of the things I I find interesting

187
00:07:46,620 --> 00:07:52,889
is what you say is you sort of try and

188
00:07:49,379 --> 00:07:54,569
match the speed of the object you're

189
00:07:52,889 --> 00:07:56,969
going to go and orbit around or visit

190
00:07:54,569 --> 00:07:57,870
and instead of just blasting there as

191
00:07:56,970 --> 00:08:00,300
quickly as you can

192
00:07:57,870 --> 00:08:03,930
other than patience and a good

193
00:08:00,300 --> 00:08:05,670
understanding of Newtonian mechanics are

194
00:08:03,930 --> 00:08:07,230
there any other challenges involved with

195
00:08:05,670 --> 00:08:10,620
doing that I mean to me what seem like

196
00:08:07,230 --> 00:08:12,750
just getting there would be the

197
00:08:10,620 --> 00:08:14,699
punchline that'd be the best part it is

198
00:08:12,750 --> 00:08:16,259
a cheaper for example or is are there

199
00:08:14,699 --> 00:08:20,370
any advantages for doing it this way

200

00:08:16,259 --> 00:08:23,310
versus the the old-fashioned way so the

201
00:08:20,370 --> 00:08:26,670
advantage of doing this is for less fuel

202
00:08:23,310 --> 00:08:28,139
you're able to visit more bodies and so

203
00:08:26,670 --> 00:08:32,159
we're basically getting two missions for

204
00:08:28,139 --> 00:08:34,379
the price of one right now with than we

205
00:08:32,159 --> 00:08:38,159
are the first spacecraft ever that will

206
00:08:34,379 --> 00:08:39,870
orbit two different bodies so I think

207
00:08:38,159 --> 00:08:41,909
that's really cool that this ion

208
00:08:39,870 --> 00:08:45,000
propulsion technology has really enabled

209
00:08:41,909 --> 00:08:48,750
us to do these interesting missions okay

210
00:08:45,000 --> 00:08:50,759
so John yang let me ask you you you are

211
00:08:48,750 --> 00:08:52,179
involved with Hubble observations of

212
00:08:50,759 --> 00:08:55,750
Ceres correct

213
00:08:52,179 --> 00:08:58,089
yes and so like what role did Hubble

214
00:08:55,750 --> 00:08:59,250

play in its bubble playing in all of

215

00:08:58,090 --> 00:09:02,740

this

216

00:08:59,250 --> 00:09:04,659

well how about actually you know before

217

00:09:02,740 --> 00:09:06,490

before before tongue has to a serious we

218

00:09:04,659 --> 00:09:08,379

want to know as much as we we know no

219

00:09:06,490 --> 00:09:10,360

one who know as much as we can about

220

00:09:08,379 --> 00:09:12,639

series in order to do our planning work

221

00:09:10,360 --> 00:09:14,740

and that's what Hubble comes into play

222

00:09:12,639 --> 00:09:16,659

and the advantage of Hubble is that

223

00:09:14,740 --> 00:09:19,750

Hubble has the best per solution we can

224

00:09:16,659 --> 00:09:21,490

ever get now right now you know some

225

00:09:19,750 --> 00:09:22,419

people would say okay ground-based you

226

00:09:21,490 --> 00:09:24,009

know there are some very large

227

00:09:22,419 --> 00:09:26,229

ground-based obsolete ground-based

228

00:09:24,009 --> 00:09:29,379

telescopes that can give us good

229
00:09:26,230 --> 00:09:31,210
resolution but you know Hubble although

230
00:09:29,379 --> 00:09:33,909
it's not not as large as those large

231
00:09:31,210 --> 00:09:35,740
ground-based telescopes it's above the

232
00:09:33,909 --> 00:09:37,899
earth atmosphere which is a really

233
00:09:35,740 --> 00:09:41,259
really really good advantage over those

234
00:09:37,899 --> 00:09:43,990
ground-based telescopes so Hubble give

235
00:09:41,259 --> 00:09:47,470
us very high-resolution image of Ceres

236
00:09:43,990 --> 00:09:50,019
in a very stable condition so from her I

237
00:09:47,470 --> 00:09:52,269
mean I would say that so far her

238
00:09:50,019 --> 00:09:54,759
observation of Ceres how images of

239
00:09:52,269 --> 00:09:56,319
seriously in particular give us the most

240
00:09:54,759 --> 00:09:58,179
knowledge about the serving what the

241
00:09:56,320 --> 00:10:01,420
surface of Ceres looks like before don't

242
00:09:58,179 --> 00:10:02,589
guess based on these Hubble images we'll

243
00:10:01,419 --> 00:10:05,949
be able to do a lot of planning work

244
00:10:02,590 --> 00:10:08,680
okay great so Scott's got a an animated

245
00:10:05,950 --> 00:10:12,460
gif going of some early observations of

246
00:10:08,679 --> 00:10:14,259
series back in 2003 2004 is that are

247
00:10:12,460 --> 00:10:18,220
these are these images you you were

248
00:10:14,259 --> 00:10:21,220
involved in yes I was actually fortunate

249
00:10:18,220 --> 00:10:23,170
enough to get him or get to get to get

250
00:10:21,220 --> 00:10:25,570
at the chance to analyze this data when

251
00:10:23,169 --> 00:10:29,559
I was still doing my PhD and I was like

252
00:10:25,570 --> 00:10:31,270
nearly 10 years ago Wow so and we've got

253
00:10:29,559 --> 00:10:37,659
we've got more recent observations cause

254
00:10:31,269 --> 00:10:39,009
somewhere I believe correct yeah this

255
00:10:37,659 --> 00:10:41,110
set of observation this set of

256
00:10:39,009 --> 00:10:42,939
observation are still the best image of

257

00:10:41,110 --> 00:10:44,710
Ceres okay because this data from

258
00:10:42,940 --> 00:10:46,720
observation was taken with the high

259
00:10:44,710 --> 00:10:49,300
resolution channel on the advanced

260
00:10:46,720 --> 00:10:53,350
camera for surveys of Hubble and that

261
00:10:49,299 --> 00:10:57,039
channel is not working anymore so so max

262
00:10:53,350 --> 00:10:58,120
I described for us this data here that

263
00:10:57,039 --> 00:10:59,529
you you are the one you were

264
00:10:58,120 --> 00:11:01,060
instrumental I think in getting some of

265
00:10:59,529 --> 00:11:04,209
your process Breck

266
00:11:01,059 --> 00:11:04,989
yeah so I kind of came late to the to

267
00:11:04,210 --> 00:11:07,060
the game here

268
00:11:04,990 --> 00:11:10,659
I wasn't directly involved I was not a

269
00:11:07,059 --> 00:11:12,219
co I and this program back in 2003 2004

270
00:11:10,659 --> 00:11:14,549
was actually a telecon that I was in

271
00:11:12,220 --> 00:11:19,330

with John yang Lee much later like in

272

00:11:14,549 --> 00:11:22,089

2005 or six I think when he mentioned

273

00:11:19,330 --> 00:11:24,460

that you know the data a typical program

274

00:11:22,090 --> 00:11:26,740

produces lots of data and he was using

275

00:11:24,460 --> 00:11:28,269

some of it there was some also some as

276

00:11:26,740 --> 00:11:29,860

he mentioned some high-resolution

277

00:11:28,269 --> 00:11:32,639

channel images where there was a sub

278

00:11:29,860 --> 00:11:35,230

sampling the other box used which means

279

00:11:32,639 --> 00:11:37,330

we did that the telescope makes small

280

00:11:35,230 --> 00:11:40,750

little shifts to sample an object better

281

00:11:37,330 --> 00:11:42,910

and you can actually get better image

282

00:11:40,750 --> 00:11:45,940

resolution in post-processing of the

283

00:11:42,909 --> 00:11:47,740

image if you do this strategy but then

284

00:11:45,940 --> 00:11:51,940

it's very kind of tricky to put the

285

00:11:47,740 --> 00:11:53,470

image together so I realized that now

286
00:11:51,940 --> 00:11:55,990
this was just a that you know we were

287
00:11:53,470 --> 00:11:58,690
sitting on the best image of series ever

288
00:11:55,990 --> 00:12:00,789
taken and but it was going to take some

289
00:11:58,690 --> 00:12:03,670
work to really put together the image

290
00:12:00,789 --> 00:12:05,679
that you see there and I kind of made a

291
00:12:03,669 --> 00:12:07,209
mental note to myself that all I should

292
00:12:05,679 --> 00:12:08,289
go get that data and do something with

293
00:12:07,210 --> 00:12:09,970
it you know it's been sitting there for

294
00:12:08,289 --> 00:12:11,199
a couple of years and see if I can

295
00:12:09,970 --> 00:12:13,629
produce you know the highest resolution

296
00:12:11,200 --> 00:12:15,070
image and then like but I didn't really

297
00:12:13,629 --> 00:12:18,519
get to it right away but a few months

298
00:12:15,070 --> 00:12:20,560
later this was the summer of 2006 when

299
00:12:18,519 --> 00:12:24,100
the IAE was voting on what is and isn't

300
00:12:20,559 --> 00:12:25,719
the planet and you might recall that the

301
00:12:24,100 --> 00:12:28,300
original proposal was going to be

302
00:12:25,720 --> 00:12:30,519
inclusive include Pluto and you may not

303
00:12:28,299 --> 00:12:32,829
recall that it was going to also include

304
00:12:30,519 --> 00:12:36,009
Ceres Ceres was on the brink of planet

305
00:12:32,830 --> 00:12:40,509
hood in the summer of 2006 it seemed but

306
00:12:36,009 --> 00:12:41,769
it wasn't so so I realized well if you

307
00:12:40,509 --> 00:12:44,799
know Ceres is going to have its

308
00:12:41,769 --> 00:12:46,449
coming-out party and we're sitting on

309
00:12:44,799 --> 00:12:48,129
the best image we better you know do

310
00:12:46,450 --> 00:12:50,980
what we can to generate the best image

311
00:12:48,129 --> 00:12:53,080
and and make sure it's out there on the

312
00:12:50,980 --> 00:12:54,670
day that it becomes a planet well you

313
00:12:53,080 --> 00:12:56,020
know how the story ends that you know

314

00:12:54,669 --> 00:12:58,899
there was an alternative proposal that

315
00:12:56,019 --> 00:13:00,970
was put forth and a more exclusive

316
00:12:58,899 --> 00:13:04,529
definition of planet hood that excluded

317
00:13:00,970 --> 00:13:07,120
both Pluto and Ceres and so nonetheless

318
00:13:04,529 --> 00:13:09,879
it was great to put out you know the

319
00:13:07,120 --> 00:13:11,320
best yet image of Ceres and we literally

320
00:13:09,879 --> 00:13:13,840
put it out on the day of the IU

321
00:13:11,320 --> 00:13:14,920
announcement in the summer of 2006 kind

322
00:13:13,840 --> 00:13:17,110
of quietly we weren't

323
00:13:14,919 --> 00:13:19,240
trying to politicize the image or

324
00:13:17,110 --> 00:13:21,129
suggest one way or the other that this

325
00:13:19,240 --> 00:13:23,350
image you know would determine whether

326
00:13:21,129 --> 00:13:25,240
Ceres is a planet or not but nonetheless

327
00:13:23,350 --> 00:13:27,700
it would have Timmy it would have seemed

328
00:13:25,240 --> 00:13:29,799

almost irresponsible of us to be sitting

329

00:13:27,700 --> 00:13:31,720

on the best image of Ceres and in the

330

00:13:29,799 --> 00:13:34,169

world can't see it I'm really the

331

00:13:31,720 --> 00:13:37,089

biggest day in series life right tonight

332

00:13:34,169 --> 00:13:39,909

so so I was very proud that we were able

333

00:13:37,089 --> 00:13:42,310

to work on that data and generate that

334

00:13:39,909 --> 00:13:44,169

that image from the older data which I

335

00:13:42,309 --> 00:13:45,809

think Joel Parker and Lucy McFadden and

336

00:13:44,169 --> 00:13:48,099

John yang had been working on for years

337

00:13:45,809 --> 00:13:49,919

and getting good science results from

338

00:13:48,100 --> 00:13:52,180

very important science results so uh

339

00:13:49,919 --> 00:13:54,009

yeah sort of you know it sort of ties

340

00:13:52,179 --> 00:13:55,629

into that whole planet debate and and

341

00:13:54,009 --> 00:13:58,179

and so that's why that image actually

342

00:13:55,629 --> 00:14:00,220

came out several years after it was

343
00:13:58,179 --> 00:14:02,138
obtained it was obtained what in 2003

344
00:14:00,220 --> 00:14:04,329
and I guess it was summer of 2006 when

345
00:14:02,139 --> 00:14:06,730
we actually created and released the

346
00:14:04,328 --> 00:14:08,078
image that we were just seeing cool so

347
00:14:06,730 --> 00:14:09,940
I've got it so here's what we're talking

348
00:14:08,078 --> 00:14:11,679
about folks I have a graphic up here

349
00:14:09,940 --> 00:14:13,959
about this shows though the various

350
00:14:11,679 --> 00:14:18,429
comparisons of sizes to different

351
00:14:13,958 --> 00:14:19,629
objects in the solar system and Carrie

352
00:14:18,429 --> 00:14:21,309
could I get you to comment on this a

353
00:14:19,629 --> 00:14:23,588
little bit you can see how big series is

354
00:14:21,309 --> 00:14:26,219
compared to Vesta what are these other

355
00:14:23,589 --> 00:14:29,140
things that are listed in here as well

356
00:14:26,220 --> 00:14:30,339
yeah so the other asteroids listed are

357
00:14:29,139 --> 00:14:33,429
some of the asteroids that we've

358
00:14:30,339 --> 00:14:35,680
explored with different spacecraft so

359
00:14:33,429 --> 00:14:38,769
just to give you a different idea of the

360
00:14:35,679 --> 00:14:42,578
size the diameter of Ceres is about the

361
00:14:38,769 --> 00:14:45,820
diameter of Texas invested same concept

362
00:14:42,578 --> 00:14:48,278
but with Arizona so they're really big

363
00:14:45,820 --> 00:14:50,320
compared to all the other asteroids that

364
00:14:48,278 --> 00:14:51,939
we've explored and so all the other

365
00:14:50,320 --> 00:14:53,920
asteroids are just these little lumps of

366
00:14:51,940 --> 00:14:57,760
rock but series investor are just

367
00:14:53,919 --> 00:15:00,099
completely different and so Ceres is the

368
00:14:57,759 --> 00:15:02,528
dwarf planet and Vesta is a proto planet

369
00:15:00,100 --> 00:15:05,350
it was trying to form a to be a planet

370
00:15:02,528 --> 00:15:07,028
never quite made it so they're not quite

371

00:15:05,350 --> 00:15:12,778
just the lumps of rock floating around

372
00:15:07,028 --> 00:15:16,629
in the asteroid belt okay so the the

373
00:15:12,778 --> 00:15:18,429
there's lots of different sizes here and

374
00:15:16,629 --> 00:15:21,039
obviously Ceres is the largest in there

375
00:15:18,429 --> 00:15:25,649
John yay can I can I get you to give us

376
00:15:21,039 --> 00:15:28,769
a comment on how important are these

377
00:15:25,649 --> 00:15:32,009
these small worlds like Ceres in Seoul

378
00:15:28,769 --> 00:15:33,389
systems do they play any special role in

379
00:15:32,009 --> 00:15:34,919
the formation of planets or are they

380
00:15:33,389 --> 00:15:37,350
just a byproduct of solar system

381
00:15:34,919 --> 00:15:38,389
formation what exactly are bodies like

382
00:15:37,350 --> 00:15:41,879
Ceres

383
00:15:38,389 --> 00:15:43,860
well Dominion was depending on how you

384
00:15:41,879 --> 00:15:45,539
think about these small objects you get

385
00:15:43,860 --> 00:15:48,089

you know different analyst and Annalee

386

00:15:45,539 --> 00:15:49,919

analogies some people say okay these are

387

00:15:48,089 --> 00:15:52,499

the building blocks of their planets of

388

00:15:49,919 --> 00:15:53,719

the planetary system because you know

389

00:15:52,499 --> 00:15:57,869

you know in the early solar system

390

00:15:53,720 --> 00:15:59,699

weirdos the dust that condensed out from

391

00:15:57,869 --> 00:16:01,739

the gas first NATO made out of their

392

00:15:59,698 --> 00:16:04,498

small bodies and then those small bodies

393

00:16:01,739 --> 00:16:07,259

accrete and grow and kneeled to today's

394

00:16:04,499 --> 00:16:09,928

big planets but then during this process

395

00:16:07,259 --> 00:16:12,269

a lot of a large fraction of these you

396

00:16:09,928 --> 00:16:14,850

know these small bodies are actually

397

00:16:12,269 --> 00:16:17,519

ejected out of solar system and also on

398

00:16:14,850 --> 00:16:20,790

their son left you know most of them are

399

00:16:17,519 --> 00:16:23,730

in the current currently in in-between

400
00:16:20,789 --> 00:16:26,248
the orbit of Mars and Jupiter and those

401
00:16:23,730 --> 00:16:28,980
are what we know today as as the main

402
00:16:26,249 --> 00:16:30,629
belt men asteroid belt and then those

403
00:16:28,980 --> 00:16:32,129
those small bodies they collide with

404
00:16:30,629 --> 00:16:33,839
each other like when each with each

405
00:16:32,129 --> 00:16:36,269
other and they they become small

406
00:16:33,839 --> 00:16:38,160
fragments so in that sense you can say

407
00:16:36,269 --> 00:16:40,110
okay these are probably the junkyard of

408
00:16:38,159 --> 00:16:42,419
a solar system but I would say that

409
00:16:40,110 --> 00:16:44,879
these are probably you know I think I

410
00:16:42,419 --> 00:16:47,490
like the I like the analogy I like the

411
00:16:44,879 --> 00:16:49,499
best a star these are the fossils of the

412
00:16:47,490 --> 00:16:53,129
solar system because you know these are

413
00:16:49,499 --> 00:16:54,869
the the ODE remnants from the formation

414
00:16:53,129 --> 00:16:56,610
of the solar system and then they're

415
00:16:54,869 --> 00:16:58,678
preserved so well that we can still

416
00:16:56,610 --> 00:17:00,659
study today to infer what's going on at

417
00:16:58,678 --> 00:17:02,879
the beginning of the solar system so I

418
00:17:00,659 --> 00:17:05,939
have a graphic up of what I guess you

419
00:17:02,879 --> 00:17:09,179
guys think series is made of there's

420
00:17:05,939 --> 00:17:12,600
this there's layers to it apparently can

421
00:17:09,179 --> 00:17:18,630
you comment on this diagram what I see

422
00:17:12,599 --> 00:17:20,250
is a Hubble logo you do okay John yang

423
00:17:18,630 --> 00:17:22,740
what what they're showing is sort of an

424
00:17:20,250 --> 00:17:25,439
artist's rendering of different

425
00:17:22,740 --> 00:17:27,870
differentiation of the core of series so

426
00:17:25,439 --> 00:17:29,070
showing the thin dusty outer crust the

427
00:17:27,869 --> 00:17:31,819
rocky inner core and then most

428

00:17:29,069 --> 00:17:36,418
excitingly the water ice layer right

429
00:17:31,819 --> 00:17:38,548
yeah no I said okay good yeah probably

430
00:17:36,419 --> 00:17:39,730
because I'm using the Wi-Fi wireless

431
00:17:38,548 --> 00:17:41,589
today and my

432
00:17:39,730 --> 00:17:45,839
even actually it's probably not not that

433
00:17:41,589 --> 00:17:45,839
good just blame the oh no I see the okay

434
00:17:47,400 --> 00:17:52,450
this is an interesting diagram so yeah

435
00:17:51,069 --> 00:17:54,519
I'd like you to comment on a little bit

436
00:17:52,450 --> 00:17:56,798
and maybe tell us how we know that why

437
00:17:54,519 --> 00:17:59,769
we think there might be these water ice

438
00:17:56,798 --> 00:18:02,048
layers in there sure yeah

439
00:17:59,769 --> 00:18:03,940
so at the beginning people we know much

440
00:18:02,048 --> 00:18:06,039
about series everybody I think okay

441
00:18:03,940 --> 00:18:09,039
serious you know it's just a big big

442
00:18:06,039 --> 00:18:11,980

chunk of rock and it's it's the same

443

00:18:09,039 --> 00:18:13,480

everywhere inside well no matter whether

444

00:18:11,980 --> 00:18:15,569

you are sitting on the surface or you'll

445

00:18:13,480 --> 00:18:17,890

go into the into the center of the body

446

00:18:15,569 --> 00:18:19,808

so that's what we call that and

447

00:18:17,890 --> 00:18:22,690

differentiate it that means everywhere

448

00:18:19,808 --> 00:18:24,700

it's the same inside and then what makes

449

00:18:22,690 --> 00:18:27,039

it differentiate it that's you know if

450

00:18:24,700 --> 00:18:31,210

it has enough like we call that

451

00:18:27,039 --> 00:18:32,950

radioactive heating then it was the

452

00:18:31,210 --> 00:18:34,929

temperature and the temperature inside

453

00:18:32,950 --> 00:18:37,509

series were increased and then that will

454

00:18:34,929 --> 00:18:39,429

melt the material and then different

455

00:18:37,509 --> 00:18:41,679

material with different melting point

456

00:18:39,429 --> 00:18:43,690

with different density there were there

457
00:18:41,679 --> 00:18:45,669
were you know sink two different tabs

458
00:18:43,690 --> 00:18:48,880
and that makes it differentiate it and

459
00:18:45,669 --> 00:18:51,460
we actually know this result from the

460
00:18:48,880 --> 00:18:53,290
Hubble data from the 2003 - and for

461
00:18:51,460 --> 00:18:55,569
Hubble data I just you just a soul and

462
00:18:53,289 --> 00:18:57,339
from that data we measure the shape we

463
00:18:55,569 --> 00:19:00,039
measure the density of series and then

464
00:18:57,339 --> 00:19:01,928
from that people can make some models

465
00:19:00,039 --> 00:19:04,539
and in the models people think okay

466
00:19:01,929 --> 00:19:07,000
series is most likely differentiated to

467
00:19:04,539 --> 00:19:10,139
a core and metal and a crust like this

468
00:19:07,000 --> 00:19:13,900
like what you see here in this graph and

469
00:19:10,140 --> 00:19:16,059
and also from that set of data we simply

470
00:19:13,900 --> 00:19:17,740
measure that density and we have some

471
00:19:16,058 --> 00:19:19,899
idea about you know the densities are

472
00:19:17,740 --> 00:19:22,808
like twice of the density of water and

473
00:19:19,900 --> 00:19:24,400
then we also we also have some idea

474
00:19:22,808 --> 00:19:26,849
about what's the composition series

475
00:19:24,400 --> 00:19:30,309
which is more like you know carbonaceous

476
00:19:26,849 --> 00:19:32,199
chondrite which is like like you know

477
00:19:30,308 --> 00:19:34,149
carbonates on the earth

478
00:19:32,200 --> 00:19:37,480
no not carbonates by something like that

479
00:19:34,150 --> 00:19:39,100
made up of carbon minerals okay so we

480
00:19:37,480 --> 00:19:41,980
know the intensity of those things are

481
00:19:39,099 --> 00:19:43,990
like three so that that tells us that

482
00:19:41,980 --> 00:19:47,019
okay you know there must be something

483
00:19:43,990 --> 00:19:49,509
that's less dense than then blocking

484
00:19:47,019 --> 00:19:53,170
series and most likely composition would

485

00:19:49,509 --> 00:19:55,119
be water and so from those calculation

486
00:19:53,170 --> 00:19:57,490
we thought that okay they should be like

487
00:19:55,119 --> 00:19:59,919
a quarter of the mass in series made of

488
00:19:57,490 --> 00:20:02,380
water so that's what you see here and

489
00:19:59,920 --> 00:20:04,150
you know theoretically rockets they came

490
00:20:02,380 --> 00:20:07,120
in and then they use on their models

491
00:20:04,150 --> 00:20:09,759
then they say okay so series should have

492
00:20:07,119 --> 00:20:12,189
its water you know above the chord

493
00:20:09,759 --> 00:20:14,680
course mostly like rocky and dry and

494
00:20:12,190 --> 00:20:17,529
then the water will you know be above

495
00:20:14,680 --> 00:20:20,350
the rocky core and that the and those

496
00:20:17,529 --> 00:20:22,000
water might be you know liquids and it

497
00:20:20,349 --> 00:20:23,709
should be liquid at the beginning when

498
00:20:22,000 --> 00:20:25,900
the temperature is high enough and then

499
00:20:23,710 --> 00:20:28,059

as the temperature goes went on and the

500

00:20:25,900 --> 00:20:30,850

this this water will condense and will

501

00:20:28,059 --> 00:20:33,940

freeze to ice and that's what most work

502

00:20:30,849 --> 00:20:36,879

water should be like today you know it's

503

00:20:33,940 --> 00:20:38,950

a big layer of ice and also they might

504

00:20:36,880 --> 00:20:40,060

even be some small errors with liquid

505

00:20:38,950 --> 00:20:41,590

water that's people are really

506

00:20:40,059 --> 00:20:44,349

interested because if you have liquid

507

00:20:41,589 --> 00:20:45,669

water than before you usually I imagine

508

00:20:44,349 --> 00:20:49,599

eight and they would think okay then

509

00:20:45,670 --> 00:20:51,580

maybe some kind of right and so yeah so

510

00:20:49,599 --> 00:20:55,119

that's exciting I mean that that's real

511

00:20:51,579 --> 00:20:56,759

and Mac sent me an image earlier that

512

00:20:55,119 --> 00:21:01,539

I'm gonna share here just okay

513

00:20:56,759 --> 00:21:04,119

comparison is the the amount of water we

514
00:21:01,539 --> 00:21:05,829
were seeing there on Ceres compared to

515
00:21:04,119 --> 00:21:10,029
the amount of fresh water we see here on

516
00:21:05,829 --> 00:21:12,549
earth yeah this graphic is just showing

517
00:21:10,029 --> 00:21:14,769
water there is on earth this is from the

518
00:21:12,549 --> 00:21:17,440
USGS they have I love this graphic that

519
00:21:14,769 --> 00:21:18,879
they've produced it shows you know that

520
00:21:17,440 --> 00:21:20,529
earth really doesn't have as much water

521
00:21:18,880 --> 00:21:22,360
as you think I mean we know earth is

522
00:21:20,529 --> 00:21:24,490
cover covered with seventy percent water

523
00:21:22,359 --> 00:21:26,259
but really it's like basically

524
00:21:24,490 --> 00:21:30,039
paper-thin it's really not as much water

525
00:21:26,259 --> 00:21:31,599
as you think it's and so if you scoop it

526
00:21:30,039 --> 00:21:33,039
all up into a sphere you see that you

527
00:21:31,599 --> 00:21:34,449
know all the water on earth isn't much

528
00:21:33,039 --> 00:21:37,029
bigger than Texas and all the fresh

529
00:21:34,450 --> 00:21:39,640
water is even smaller and all the water

530
00:21:37,029 --> 00:21:41,019
the groundwater is you know including

531
00:21:39,640 --> 00:21:42,100
all the groundwater and things like that

532
00:21:41,019 --> 00:21:43,539
I think there's three different blobs

533
00:21:42,099 --> 00:21:44,799
they're reflecting different you know

534
00:21:43,539 --> 00:21:46,899
depending on how much water you're

535
00:21:44,799 --> 00:21:48,879
counting but you know one of the moments

536
00:21:46,900 --> 00:21:51,220
oh wait wait hang on the big blob is all

537
00:21:48,880 --> 00:21:53,020
the seawater saltwater I think that's

538
00:21:51,220 --> 00:21:55,059
all the water on earth whether it's in

539
00:21:53,019 --> 00:22:00,309
the oceans or freshwater or beneath the

540
00:21:55,059 --> 00:22:02,289
ground you can read the okay I'm all the

541
00:22:00,309 --> 00:22:04,450
water including freshwater and saltwater

542

00:22:02,289 --> 00:22:06,730
okay and then the little dive I think it

543
00:22:04,450 --> 00:22:08,650
might include ground water I'm not sure

544
00:22:06,730 --> 00:22:10,569
but but then this the next one I think

545
00:22:08,650 --> 00:22:12,850
is freshwater and I don't know what the

546
00:22:10,569 --> 00:22:15,909
smallest one is it might just be rivers

547
00:22:12,849 --> 00:22:17,980
or something but you get an idea that

548
00:22:15,910 --> 00:22:19,600
you know there isn't as much water on

549
00:22:17,980 --> 00:22:22,298
earth as you might think just looking at

550
00:22:19,599 --> 00:22:25,178
the Big Blue Marble you know and some

551
00:22:22,298 --> 00:22:26,918
illustrative you know one of the one of

552
00:22:25,179 --> 00:22:28,750
the amazing factoids you know you look

553
00:22:26,919 --> 00:22:30,730
at that diagram that we're just looking

554
00:22:28,750 --> 00:22:32,109
at if how much water ice is that the

555
00:22:30,730 --> 00:22:34,000
simple fact that there could be more

556
00:22:32,109 --> 00:22:35,918

fresh water on unserious than there is

557

00:22:34,000 --> 00:22:37,329

on earth you know that fact at first

558

00:22:35,919 --> 00:22:38,860

when like when you first hear that it

559

00:22:37,329 --> 00:22:40,659

sounds crazy how can that possibly be

560

00:22:38,859 --> 00:22:42,129

true but when you look at this graphic

561

00:22:40,660 --> 00:22:44,169

you see it's actually not that difficult

562

00:22:42,130 --> 00:22:46,500

for it to be true um but nonetheless

563

00:22:44,169 --> 00:22:48,940

it's still amazing if you think about

564

00:22:46,500 --> 00:22:51,640

how much you know finding water in the

565

00:22:48,940 --> 00:22:56,110

solar system is a driving scientific you

566

00:22:51,640 --> 00:22:58,330

know goal that if Ceres is loaded with

567

00:22:56,109 --> 00:22:59,709

water as we think it might be then it

568

00:22:58,329 --> 00:23:03,519

makes series a much more exciting

569

00:22:59,710 --> 00:23:05,558

astrobiological you know consideration

570

00:23:03,519 --> 00:23:07,539

in the solar system and it's much closer

571
00:23:05,558 --> 00:23:09,819
than a lot of the other places we're

572
00:23:07,539 --> 00:23:12,639
considering you know like Enceladus and

573
00:23:09,819 --> 00:23:14,168
Europa and other outer moons of this

574
00:23:12,640 --> 00:23:15,730
outer solar system so it's a kind of

575
00:23:14,169 --> 00:23:17,740
exciting that now there's this water

576
00:23:15,730 --> 00:23:20,110
world that's actually much much closer

577
00:23:17,740 --> 00:23:21,490
it's in the asteroid belt so a little

578
00:23:20,109 --> 00:23:22,928
farther away than Mars which of course

579
00:23:21,490 --> 00:23:25,450
is also very exciting and interesting

580
00:23:22,929 --> 00:23:27,370
and well studied but I often think that

581
00:23:25,450 --> 00:23:30,190
boy I would love to send a rover to

582
00:23:27,369 --> 00:23:32,558
Ceres no kidding look at this John Yanks

583
00:23:30,190 --> 00:23:35,890
got a thing up here says series is for

584
00:23:32,558 --> 00:23:38,619
about 40 percent by volume of water

585
00:23:35,890 --> 00:23:41,830
compared to very tiny amounts for Earth

586
00:23:38,619 --> 00:23:44,798
and Mars you wanna comment well yeah yes

587
00:23:41,829 --> 00:23:47,109
let me explain this figure actually we

588
00:23:44,798 --> 00:23:48,668
made this speaker like last year and we

589
00:23:47,109 --> 00:23:51,219
thought it's a very good illustration

590
00:23:48,669 --> 00:23:53,320
for relatively how much water series

591
00:23:51,220 --> 00:23:55,120
might have we have to say might have

592
00:23:53,319 --> 00:23:58,899
because we're not sure completely sure

593
00:23:55,119 --> 00:24:01,000
yet okay to be cautious and so so and

594
00:23:58,900 --> 00:24:03,700
also I presented this figure in one of

595
00:24:01,000 --> 00:24:06,579
the meetings at space static Space

596
00:24:03,700 --> 00:24:08,110
Telescope Science Institute so what what

597
00:24:06,579 --> 00:24:10,269
do you see here there are three big

598
00:24:08,109 --> 00:24:11,740
spheres and the blue one you know I

599

00:24:10,269 --> 00:24:13,990
worked in ice that's the earth and then

600
00:24:11,740 --> 00:24:15,640
the the the sort of a yellow pear on one

601
00:24:13,990 --> 00:24:17,679
that's Mars and then there's another

602
00:24:15,640 --> 00:24:18,130
small one kind of reddish compared to

603
00:24:17,679 --> 00:24:20,440
others

604
00:24:18,130 --> 00:24:20,710
that's series so and the size of this

605
00:24:20,440 --> 00:24:23,230
ball

606
00:24:20,710 --> 00:24:25,720
on scale so these are they were their

607
00:24:23,230 --> 00:24:28,149
relative size then we got three our

608
00:24:25,720 --> 00:24:30,519
water sphere here these artists water

609
00:24:28,148 --> 00:24:33,398
all the water that we thought contained

610
00:24:30,519 --> 00:24:36,368
by all these different bodies so Earth

611
00:24:33,398 --> 00:24:38,319
has this much water and in dots and

612
00:24:36,368 --> 00:24:39,908
compared to the total volume of the

613
00:24:38,319 --> 00:24:42,398

earth there's only like point one

614

00:24:39,909 --> 00:24:45,249

percent of the earth body and then for

615

00:24:42,398 --> 00:24:47,589

Mars it has less water than and what's

616

00:24:45,249 --> 00:24:49,839

on and compared to my total volume Mars

617

00:24:47,589 --> 00:24:52,658

is at the count four point zero five

618

00:24:49,839 --> 00:24:56,138

fourteen percent more than there is

619

00:24:52,659 --> 00:24:57,970

another another water sphere for series

620

00:24:56,138 --> 00:25:00,368

and then based on our current standing

621

00:24:57,970 --> 00:25:02,259

Sirius has 40 percent of its volume in

622

00:25:00,368 --> 00:25:04,658

water I mean I should I should not say

623

00:25:02,259 --> 00:25:06,579

this okay sorry I should say if we take

624

00:25:04,659 --> 00:25:08,679

all the water from series out and make

625

00:25:06,579 --> 00:25:10,658

it a sphere then there's the volume of

626

00:25:08,679 --> 00:25:16,360

that sphere is forty percent of the

627

00:25:10,659 --> 00:25:18,399

volume of series okay Wow yeah and and

628
00:25:16,359 --> 00:25:20,498
from here from here what we think is

629
00:25:18,398 --> 00:25:23,168
that you know in the inner solar system

630
00:25:20,499 --> 00:25:25,240
which we say is reading the reading

631
00:25:23,169 --> 00:25:27,249
tubular okay inside including the small

632
00:25:25,240 --> 00:25:29,618
main asteroid belt including the Earth

633
00:25:27,249 --> 00:25:33,009
Mars and what anything inside like

634
00:25:29,618 --> 00:25:35,319
Mercury Venus and anything there and if

635
00:25:33,009 --> 00:25:37,269
you compare this graph you can be

636
00:25:35,319 --> 00:25:39,249
impression that Earth has the has the

637
00:25:37,269 --> 00:25:39,730
most water and then the next would be

638
00:25:39,249 --> 00:25:42,159
serious

639
00:25:39,730 --> 00:25:43,690
so serious is actually the largest water

640
00:25:42,159 --> 00:25:44,950
reservoir in the inner solar system

641
00:25:43,690 --> 00:25:47,470
other than the earth

642
00:25:44,950 --> 00:25:49,058
that's impressive yeah yeah and I gotta

643
00:25:47,470 --> 00:25:51,129
say the real shocking thing was just

644
00:25:49,058 --> 00:25:53,950
that had the percentage by volume of

645
00:25:51,128 --> 00:25:56,408
water that Earth that Earth has was I

646
00:25:53,950 --> 00:25:58,450
had no idea that I mean you're right you

647
00:25:56,409 --> 00:25:59,860
think you know all the planet surfaces

648
00:25:58,450 --> 00:26:01,058
cover most of the planet surface is

649
00:25:59,859 --> 00:26:02,288
covered with water you think it's got

650
00:26:01,058 --> 00:26:04,210
more than it does that was a real

651
00:26:02,288 --> 00:26:08,048
eye-opener so thanks for showing that so

652
00:26:04,210 --> 00:26:10,778
Hubble has set the stage for Dawn it is

653
00:26:08,048 --> 00:26:13,720
it is imaged it is imaged this minor

654
00:26:10,778 --> 00:26:15,940
planet and given us some some data with

655
00:26:13,720 --> 00:26:17,499
which to work and so I want to get I

656

00:26:15,940 --> 00:26:20,200
want to go move to dawn now but I want

657
00:26:17,499 --> 00:26:22,569
to start with a QA from Albert Bundy on

658
00:26:20,200 --> 00:26:24,669
the Q&A app who's asking will there and

659
00:26:22,569 --> 00:26:26,378
this is a good segue into into this and

660
00:26:24,669 --> 00:26:28,778
carry maybe you can address this for us

661
00:26:26,378 --> 00:26:32,288
will there be a difference between what

662
00:26:28,778 --> 00:26:34,250
Hubble is showing versus what the new

663
00:26:32,288 --> 00:26:37,009
Space Telescope and Dawn will

664
00:26:34,250 --> 00:26:39,019
and showing detailed pictures of Ceres

665
00:26:37,009 --> 00:26:40,940
so I guess when I add the way entropy

666
00:26:39,019 --> 00:26:43,609
that is what will what will series or

667
00:26:40,940 --> 00:26:44,840
what will dawn show us that we can't see

668
00:26:43,609 --> 00:26:53,629
with Hubble what do we hope for hoping

669
00:26:44,839 --> 00:26:56,000
to learn are you there yes I think you

670
00:26:53,630 --> 00:26:57,169

know it's hard to say what new surprises

671

00:26:56,000 --> 00:26:58,880

we're going to have but we're going to

672

00:26:57,169 --> 00:27:01,280

have such high resolution pictures

673

00:26:58,880 --> 00:27:03,289

compared to what we have and we were

674

00:27:01,279 --> 00:27:05,869

surprised at Vesta even though we had

675

00:27:03,288 --> 00:27:07,700

Hubble images and so I'm sure we'll be

676

00:27:05,869 --> 00:27:09,859

surprised with whatever Ceres has in

677

00:27:07,700 --> 00:27:12,169

store for us and I'd like to think of

678

00:27:09,859 --> 00:27:13,819

Donna's like a detective and we have our

679

00:27:12,169 --> 00:27:16,700

instruments and we're going to the scene

680

00:27:13,819 --> 00:27:18,589

and we're going to investigate all the

681

00:27:16,700 --> 00:27:22,009

different things that series has to

682

00:27:18,589 --> 00:27:23,538

reveal for us so I don't know what

683

00:27:22,009 --> 00:27:26,500

Sirius has in store for us but we'll

684

00:27:23,538 --> 00:27:29,929

find out yeah I guess I will say that

685
00:27:26,500 --> 00:27:31,759
recently there was a paper released by

686
00:27:29,929 --> 00:27:34,880
the Herschel Space Observatory that

687
00:27:31,759 --> 00:27:37,579
found water vapour around Ceres so

688
00:27:34,880 --> 00:27:39,950
series has some sort of mechanism that's

689
00:27:37,579 --> 00:27:44,119
putting water vapor and and causing kind

690
00:27:39,950 --> 00:27:45,980
of a thin temporary atmosphere and my

691
00:27:44,119 --> 00:27:47,479
background is in meteorology so I think

692
00:27:45,980 --> 00:27:50,720
it's very nice that series decided to

693
00:27:47,480 --> 00:27:58,509
have an atmosphere for me and so and

694
00:27:50,720 --> 00:27:58,509
Carrie loves whether she know whether

695
00:27:58,690 --> 00:28:05,269
you know I I think that we're gonna try

696
00:28:03,169 --> 00:28:07,038
and look into this and then we don't

697
00:28:05,269 --> 00:28:09,980
know what else series will have them in

698
00:28:07,038 --> 00:28:11,720
store for us so I think it'll be a very

699
00:28:09,980 --> 00:28:14,599
exciting mission over the next year

700
00:28:11,720 --> 00:28:16,669
awesome ok so that was a good question

701
00:28:14,599 --> 00:28:18,469
Thank You Albert I appreciate it well

702
00:28:16,669 --> 00:28:22,549
then I want to share an image real quick

703
00:28:18,470 --> 00:28:26,808
to just an example of what Dawn's you

704
00:28:22,548 --> 00:28:28,279
with Vesta so here is an image also in

705
00:28:26,808 --> 00:28:30,740
the festive season since we are in

706
00:28:28,279 --> 00:28:35,149
December so here's a snowman on Vesta

707
00:28:30,740 --> 00:28:36,679
but this was taken with with Dawn so

708
00:28:35,150 --> 00:28:40,250
this is what we've been able to see an

709
00:28:36,679 --> 00:28:43,009
even smaller planetary body but the that

710
00:28:40,250 --> 00:28:47,359
this is what dawn is going to be able to

711
00:28:43,009 --> 00:28:48,038
see on Vesta much much higher resolution

712
00:28:47,359 --> 00:28:50,949
than we've been able

713

00:28:48,038 --> 00:28:52,358
with Hubble right so right now Hubble is

714
00:28:50,950 --> 00:28:55,569
still able to do a slightly better job

715
00:28:52,358 --> 00:28:58,628
than dawn is but you were saying by what

716
00:28:55,569 --> 00:29:03,388
time carry will will dawn be doing a

717
00:28:58,628 --> 00:29:06,898
better job than Hubble January 25th so

718
00:29:03,388 --> 00:29:09,339
and you said it was going to be about

719
00:29:06,898 --> 00:29:10,538
one and a half times better than the

720
00:29:09,339 --> 00:29:11,648
Hubble resolution and then it's just

721
00:29:10,538 --> 00:29:13,538
gonna keep getting better from there

722
00:29:11,648 --> 00:29:15,758
correct yep

723
00:29:13,538 --> 00:29:17,259
okay and we add Hubble couldn't be more

724
00:29:15,759 --> 00:29:20,769
thrilled that our images are going to be

725
00:29:17,259 --> 00:29:23,108
very obsolete I think that's awesome I

726
00:29:20,769 --> 00:29:25,058
agree because of course most of the

727
00:29:23,108 --> 00:29:26,470

solar system objects we observe with

728

00:29:25,058 --> 00:29:29,440

Hubble will never be visited by a

729

00:29:26,470 --> 00:29:31,899

spacecraft so when they are it's really

730

00:29:29,440 --> 00:29:33,548

exciting so I got you up here maxin you

731

00:29:31,898 --> 00:29:35,888

I'm let's go back to the data for a

732

00:29:33,548 --> 00:29:38,048

minute for Hubble data you've got some

733

00:29:35,888 --> 00:29:39,368

raw images right of what these data look

734

00:29:38,048 --> 00:29:40,509

like can you just kind of maybe share

735

00:29:39,368 --> 00:29:42,398

with us a little bit about how this

736

00:29:40,509 --> 00:29:44,348

stuff comes off the telescope I know

737

00:29:42,398 --> 00:29:46,839

we've done this before but not everybody

738

00:29:44,348 --> 00:29:48,158

is seen every Hubble hangout so it's

739

00:29:46,839 --> 00:29:50,558

always nice to show people what Hubble

740

00:29:48,159 --> 00:29:53,259

gives us and what you what magic you do

741

00:29:50,558 --> 00:29:55,749

with it sure yeah actually didn't have

742
00:29:53,259 --> 00:29:57,399
the raw data six years ago sorry I did I

743
00:29:55,749 --> 00:29:59,019
did just get some and I pulled one up

744
00:29:57,398 --> 00:30:01,839
I'm not sure it's the best example but

745
00:29:59,019 --> 00:30:03,159
I'll do a screen share here I guess so

746
00:30:01,839 --> 00:30:05,558
yeah I mentioned that there was quite a

747
00:30:03,159 --> 00:30:16,659
bit of work to turn you know the raw

748
00:30:05,558 --> 00:30:18,668
images into a screen share okay let me

749
00:30:16,659 --> 00:30:19,960
know if you're seeing an image here okay

750
00:30:18,669 --> 00:30:22,629
you got it

751
00:30:19,960 --> 00:30:25,269
yep I got it out okay so a not so

752
00:30:22,628 --> 00:30:28,118
impressive image of Ceres here from 2003

753
00:30:25,269 --> 00:30:31,479
where a couple of things first it looks

754
00:30:28,118 --> 00:30:34,209
like an egg yeah because Hubble produces

755
00:30:31,479 --> 00:30:35,409
distorted images it's one of the ways

756
00:30:34,210 --> 00:30:36,999
we're so sensitive is that we minimize

757
00:30:35,409 --> 00:30:38,590
number of reflections and so we don't

758
00:30:36,999 --> 00:30:40,348
bother to do an extra one that would

759
00:30:38,589 --> 00:30:43,689
then under storage so we have to

760
00:30:40,348 --> 00:30:45,158
understand processing you also notice a

761
00:30:43,690 --> 00:30:47,590
whole bunch of flex in the image those

762
00:30:45,159 --> 00:30:49,359
are cosmic rays which are just flying

763
00:30:47,589 --> 00:30:50,798
around space high-energy particles that

764
00:30:49,358 --> 00:30:53,378
just go shooting through every single

765
00:30:50,798 --> 00:30:54,999
image so we have to have ways to clean

766
00:30:53,378 --> 00:30:58,238
them out and generally we take multiple

767
00:30:54,999 --> 00:31:01,690
exposures and combine them to get rid of

768
00:30:58,239 --> 00:31:03,009
the junk and in this case so I'm

769
00:31:01,690 --> 00:31:04,870
in that you know we took a series of

770

00:31:03,009 --> 00:31:06,278
images and shifted them each a little

771
00:31:04,869 --> 00:31:08,079
bit so if i zoom way in you can actually

772
00:31:06,278 --> 00:31:11,619
see the individual pixels kind of starts

773
00:31:08,079 --> 00:31:13,240
to look like a pile of Legos you know

774
00:31:11,619 --> 00:31:15,128
you start to see the individual pixels

775
00:31:13,240 --> 00:31:18,099
and if we do little shifts on the order

776
00:31:15,128 --> 00:31:19,418
of like half of those pixels we can

777
00:31:18,099 --> 00:31:21,699
actually sample the image you can see

778
00:31:19,419 --> 00:31:24,580
I'm trying to stretch it but as best I

779
00:31:21,700 --> 00:31:27,819
can and you still can't see many service

780
00:31:24,579 --> 00:31:29,548
features like this and very pixelated so

781
00:31:27,819 --> 00:31:33,339
that's kind of what I'm starting with

782
00:31:29,548 --> 00:31:36,369
and you know sort of clean up the image

783
00:31:33,339 --> 00:31:38,769
under store at them combine them at a

784
00:31:36,369 --> 00:31:40,418

smaller pixel scale so extracting as

785

00:31:38,769 --> 00:31:41,798

much spatial information from each of

786

00:31:40,419 --> 00:31:43,389

the individual images and then combining

787

00:31:41,798 --> 00:31:45,940

it into that high resolution image that

788

00:31:43,388 --> 00:31:47,258

you see in the in that nice color press

789

00:31:45,940 --> 00:31:48,730

release image and of course then we did

790

00:31:47,259 --> 00:31:50,620

two filters so you could get a nice

791

00:31:48,730 --> 00:31:52,419

color image so that just gives you an

792

00:31:50,619 --> 00:31:53,859

idea of you know what the raw data comes

793

00:31:52,419 --> 00:31:55,360

it doesn't come shooting out of the

794

00:31:53,859 --> 00:31:56,829

telescope looking like the press release

795

00:31:55,359 --> 00:31:58,449

images there's you know usually a fair

796

00:31:56,829 --> 00:31:59,829

amount of work I always like to point

797

00:31:58,450 --> 00:32:03,129

that out when I have you on the hangouts

798

00:31:59,829 --> 00:32:04,388

because you you you do you know you're

799

00:32:03,128 --> 00:32:06,038
not inventing anything but you're

800

00:32:04,388 --> 00:32:09,459
removing artifacts and you're trying to

801

00:32:06,038 --> 00:32:11,648
get the details that the actual science

802

00:32:09,460 --> 00:32:14,230
units teased out of these images and I

803

00:32:11,648 --> 00:32:15,849
always like to to bring that up I carry

804

00:32:14,230 --> 00:32:17,440
you I have a question for you and this

805

00:32:15,849 --> 00:32:18,668
may this may not be a fair question and

806

00:32:17,440 --> 00:32:22,570
I hope I'm not putting you on the spot

807

00:32:18,669 --> 00:32:24,669
but how do the cameras on dawn do you

808

00:32:22,569 --> 00:32:27,428
know how they compare to the cameras on

809

00:32:24,669 --> 00:32:30,700
Hubble or are they higher resolution are

810

00:32:27,429 --> 00:32:32,620
they different wavelengths so the

811

00:32:30,700 --> 00:32:34,538
cameras on dawn

812

00:32:32,619 --> 00:32:37,239
are called the framing cameras and

813
00:32:34,538 --> 00:32:41,519
they're provided to us from DLR and Max

814
00:32:37,240 --> 00:32:45,339
Planck in Germany and I don't know like

815
00:32:41,519 --> 00:32:48,009
specifics of how the optics compare but

816
00:32:45,339 --> 00:32:50,319
I know that we will have some gorgeous

817
00:32:48,009 --> 00:32:52,269
images coming out of them what

818
00:32:50,319 --> 00:32:54,099
wavelength divided visible light or the

819
00:32:52,269 --> 00:32:58,569
infrared what wavelength ranges do we do

820
00:32:54,099 --> 00:33:00,219
you have there so we have a filter wheel

821
00:32:58,569 --> 00:33:02,019
in front of it so we can pick a couple

822
00:33:00,220 --> 00:33:03,940
different filters so we have some kind

823
00:33:02,019 --> 00:33:07,179
of indivisible range and some of the

824
00:33:03,940 --> 00:33:09,820
near-infrared colors and then we also

825
00:33:07,179 --> 00:33:11,769
have a visible and infrared spectrometer

826
00:33:09,819 --> 00:33:13,778
that can get more than infrared data and

827

00:33:11,769 --> 00:33:15,160
then we also have a gamma ray and

828
00:33:13,778 --> 00:33:17,799
neutron detector or gray

829
00:33:15,160 --> 00:33:21,700
and that'll be able to see kind of in

830
00:33:17,799 --> 00:33:22,720
the gamma ray Neutron range so we we can

831
00:33:21,700 --> 00:33:24,519
basically see a whole bunch of different

832
00:33:22,720 --> 00:33:26,799
wavelengths of light with our different

833
00:33:24,519 --> 00:33:27,940
instruments okay that sounds so and

834
00:33:26,799 --> 00:33:30,669
these are relative and because of the

835
00:33:27,940 --> 00:33:31,920
proximity of dawn to series you'll be

836
00:33:30,670 --> 00:33:35,019
able to get a lot of high resolution

837
00:33:31,920 --> 00:33:36,370
images from that I have and we get back

838
00:33:35,019 --> 00:33:39,879
to the Q&A app we've got a couple of

839
00:33:36,369 --> 00:33:43,179
good things here Erik sharland is asking

840
00:33:39,880 --> 00:33:45,820
what does series miss to be qualified as

841
00:33:43,180 --> 00:33:48,850

a dwarf planet I think it is a dwarf

842

00:33:45,819 --> 00:33:50,829
planet isn't it John yay

843

00:33:48,849 --> 00:33:53,709
yeah Ceres is a dwarf oh yeah so I think

844

00:33:50,829 --> 00:33:54,849
it is one that doesn't miss it is it is

845

00:33:53,710 --> 00:33:57,509
a dwarf planet but thanks for asking

846

00:33:54,849 --> 00:34:00,639
that Erik and so maybe he's asking

847

00:33:57,509 --> 00:34:06,490
missing to not be classified as a true

848

00:34:00,640 --> 00:34:09,970
planet oh because Mike Brown's out there

849

00:34:06,490 --> 00:34:11,289
just killing all sorts of things killing

850

00:34:09,969 --> 00:34:12,939
off that's right he's killing all kind

851

00:34:11,289 --> 00:34:15,960
of plans let's talk about that just

852

00:34:12,940 --> 00:34:19,148
briefly I don't know if John yang or or

853

00:34:15,960 --> 00:34:21,730
Kerry if you want to take this but what

854

00:34:19,148 --> 00:34:24,940
is the link what is the limit what's

855

00:34:21,730 --> 00:34:26,889
what's the limit what's the deciding

856
00:34:24,940 --> 00:34:35,378
factor on whether it's a planet as a

857
00:34:26,889 --> 00:34:37,690
planet or a dwarf body okay um so so

858
00:34:35,378 --> 00:34:40,569
basically to qualify to be a planet I

859
00:34:37,690 --> 00:34:44,079
think there there are three criteria one

860
00:34:40,570 --> 00:34:47,289
is that it has to be circled in a song

861
00:34:44,079 --> 00:34:49,690
that's easy and second is that it has to

862
00:34:47,289 --> 00:34:52,929
be it has to be big enough to maintain

863
00:34:49,690 --> 00:34:55,329
around it in round shape that's not very

864
00:34:52,929 --> 00:34:58,570
easy but series made it and then the

865
00:34:55,329 --> 00:35:00,460
third one is that you have to clear your

866
00:34:58,570 --> 00:35:03,760
neighborhood which means that you don't

867
00:35:00,460 --> 00:35:06,309
have any small you know many more chunks

868
00:35:03,760 --> 00:35:09,220
around you you know circling the Sun in

869
00:35:06,309 --> 00:35:11,799
in orbit very close to you so that's the

870
00:35:09,219 --> 00:35:13,449
three criteria and if you if you only

871
00:35:11,800 --> 00:35:14,860
satisfy the first two and not the last

872
00:35:13,449 --> 00:35:16,899
one then you are a dwarf planet

873
00:35:14,860 --> 00:35:19,269
well there's another one I think like

874
00:35:16,900 --> 00:35:23,289
Scott said Mike Brown has to approve but

875
00:35:19,269 --> 00:35:26,530
um okay so here's a good question from

876
00:35:23,289 --> 00:35:28,329
Albert Bundy is the maybe this was also

877
00:35:26,530 --> 00:35:30,850
for you Tanya I'm not

878
00:35:28,329 --> 00:35:33,789
or is the gravity of Ceres enough to

879
00:35:30,849 --> 00:35:36,130
attract more surrounding rock and able

880
00:35:33,789 --> 00:35:38,079
to grow in size and mass I think one of

881
00:35:36,130 --> 00:35:42,099
the criterion you just mentioned kind of

882
00:35:38,079 --> 00:35:46,480
answers that question but what is it

883
00:35:42,099 --> 00:35:49,029
even more stuff well the the you know if

884

00:35:46,480 --> 00:35:52,440
you if you have a if you want see how do

885
00:35:49,030 --> 00:35:55,870
you answer that okay if you have enough

886
00:35:52,440 --> 00:35:57,730
then you know depending on if any I'll

887
00:35:55,869 --> 00:35:59,769
depending on the you know how much how

888
00:35:57,730 --> 00:36:01,960
much material around you you're either

889
00:35:59,769 --> 00:36:04,449
grab them and grow yourself or you know

890
00:36:01,960 --> 00:36:05,440
kick them out you know at the early

891
00:36:04,449 --> 00:36:07,659
stage when you have enough material

892
00:36:05,440 --> 00:36:09,429
surrounding you then mostly you're

893
00:36:07,659 --> 00:36:11,949
you're gonna grow you're gonna you know

894
00:36:09,429 --> 00:36:14,079
attract more material and creat more

895
00:36:11,949 --> 00:36:16,419
material and you grow yourself but then

896
00:36:14,079 --> 00:36:18,099
when there's no much material around you

897
00:36:16,420 --> 00:36:19,780
and then when they're the relative

898
00:36:18,099 --> 00:36:22,869

velocity between you and your you know

899

00:36:19,780 --> 00:36:25,330

those small junks around you or high

900

00:36:22,869 --> 00:36:27,940

enough then what you do is that you you

901

00:36:25,329 --> 00:36:29,319

actually eject those objects you can't

902

00:36:27,940 --> 00:36:33,700

read out them you know you threw them

903

00:36:29,320 --> 00:36:36,039

out and so so the third criteria that

904

00:36:33,699 --> 00:36:38,259

you clear out the the parties around you

905

00:36:36,039 --> 00:36:40,420

that's actually nice to actually talk

906

00:36:38,260 --> 00:36:42,640

about talks about you know the last

907

00:36:40,420 --> 00:36:45,400

stage when you actually eject those

908

00:36:42,639 --> 00:36:48,460

chunks away from you and the massive

909

00:36:45,400 --> 00:36:51,220

series is not big enough to to to eject

910

00:36:48,460 --> 00:36:55,690

enough material around it to clear its

911

00:36:51,219 --> 00:36:56,230

orbit so although it's much messier than

912

00:36:55,690 --> 00:36:57,880

others

913
00:36:56,230 --> 00:36:59,889
other asteroids is still still not

914
00:36:57,880 --> 00:37:01,090
massive enough to do that job good

915
00:36:59,889 --> 00:37:02,559
question Albert that was that was really

916
00:37:01,090 --> 00:37:04,780
relevant for we were just then talking

917
00:37:02,559 --> 00:37:07,000
about so that's really though there can

918
00:37:04,780 --> 00:37:09,580
still be fresh craters on Ceres when Don

919
00:37:07,000 --> 00:37:11,769
gets there because not because series

920
00:37:09,579 --> 00:37:13,230
gravitationally pulled anything in under

921
00:37:11,769 --> 00:37:15,759
the surface but you know there's

922
00:37:13,230 --> 00:37:17,110
collisions most of the collisions happen

923
00:37:15,760 --> 00:37:18,580
in the early solar system but there are

924
00:37:17,110 --> 00:37:20,289
still the possibility that smaller

925
00:37:18,579 --> 00:37:22,389
asteroids could crash you know just

926
00:37:20,289 --> 00:37:23,380
crash into the surface of Ceres again

927
00:37:22,389 --> 00:37:26,379
not because it's being gravitationally

928
00:37:23,380 --> 00:37:28,349
pulled in just a simple collision we see

929
00:37:26,380 --> 00:37:30,880
other collisions of asteroids going on

930
00:37:28,349 --> 00:37:32,559
it's rare because the asteroid belt is

931
00:37:30,880 --> 00:37:41,170
much emptier than most people think it

932
00:37:32,559 --> 00:37:42,250
is we do know that there are still

933
00:37:41,170 --> 00:37:43,840
collisions you know

934
00:37:42,250 --> 00:37:45,369
currently happening and there's pretty

935
00:37:43,840 --> 00:37:48,519
good reason to expect that there will be

936
00:37:45,369 --> 00:37:51,549
relatively fresh craters on Ceres yeah

937
00:37:48,519 --> 00:37:54,960
so so Kerry I want to ask you a quick

938
00:37:51,550 --> 00:37:57,340
question about the specifics of the

939
00:37:54,960 --> 00:38:00,010
science goals of dawn with respect to

940
00:37:57,340 --> 00:38:03,010
Ceres what can you give us some specific

941

00:38:00,010 --> 00:38:10,540
things you're hoping to do and learn on

942
00:38:03,010 --> 00:38:16,360
this visit hello hello

943
00:38:10,539 --> 00:38:20,320
they look frozen eyes okay you froze but

944
00:38:16,360 --> 00:38:23,890
maybe you froze in relation to us did

945
00:38:20,320 --> 00:38:26,530
you hear my question yeah really I was

946
00:38:23,889 --> 00:38:27,849
asking about the science goals of dawn

947
00:38:26,530 --> 00:38:29,350
can you give us some overview of some

948
00:38:27,849 --> 00:38:32,139
specific science goals that you're

949
00:38:29,349 --> 00:38:37,360
hoping to achieve when you reach series

950
00:38:32,139 --> 00:38:39,789
so yeah so kind of relating to dig on as

951
00:38:37,360 --> 00:38:42,309
a detective we're going there and we

952
00:38:39,789 --> 00:38:44,110
want to map the entire surface and we

953
00:38:42,309 --> 00:38:46,539
want to get good pictures of the entire

954
00:38:44,110 --> 00:38:48,460
surface and kind of make a map and with

955
00:38:46,539 --> 00:38:50,590

that you can get the topography you can

956

00:38:48,460 --> 00:38:52,269

get the geology and the geologic units

957

00:38:50,590 --> 00:38:54,039

which is basically the type of rocks

958

00:38:52,269 --> 00:38:56,409

that are similar and you kind of group

959

00:38:54,039 --> 00:38:58,690

them together and you can actually see

960

00:38:56,409 --> 00:39:02,469

on dawn Dawn's website right now dawn

961

00:38:58,690 --> 00:39:06,730

JPL NASA gov we have a link to the Vesta

962

00:39:02,469 --> 00:39:09,549

geologic maps and so well also with the

963

00:39:06,730 --> 00:39:11,650

other instruments we'll be able to get

964

00:39:09,550 --> 00:39:14,260

mineralogical information and also

965

00:39:11,650 --> 00:39:15,639

elemental composition and given all of

966

00:39:14,260 --> 00:39:19,300

those things it will give us the big

967

00:39:15,639 --> 00:39:22,509

picture oh yes so this is a globe of

968

00:39:19,300 --> 00:39:24,400

what this is the topography of Vesta so

969

00:39:22,510 --> 00:39:25,600

Vesta isn't round so this kind of had to

970
00:39:24,400 --> 00:39:27,820
be squished to make it into a round

971
00:39:25,599 --> 00:39:30,699
shape but we'll be able to have

972
00:39:27,820 --> 00:39:32,860
something like this for series two okay

973
00:39:30,699 --> 00:39:34,389
I'm taking this home with me totally

974
00:39:32,860 --> 00:39:37,090
taking this home with me Scott you're

975
00:39:34,389 --> 00:39:39,190
just gonna rip all this off it's great I

976
00:39:37,090 --> 00:39:42,550
know I know you're gonna be like taking

977
00:39:39,190 --> 00:39:44,019
all that stuff away so so see so Morgan

978
00:39:42,550 --> 00:39:46,120
is asking on the QA app and then I'm

979
00:39:44,019 --> 00:39:50,019
gonna go to the YouTube comments and see

980
00:39:46,119 --> 00:39:52,179
if I can find anything there will let me

981
00:39:50,019 --> 00:39:54,579
see here will series be closer to app

982
00:39:52,179 --> 00:39:55,568
Hyllian or perihelion when Dawn arrives

983
00:39:54,579 --> 00:39:58,088
and

984
00:39:55,568 --> 00:40:02,380
it monitor changes in series over a full

985
00:39:58,088 --> 00:40:04,690
orbit Kerry so when we get to series

986
00:40:02,380 --> 00:40:06,338
it's moving away from the Sun and will

987
00:40:04,690 --> 00:40:09,190
be moving away from the Sun for the rest

988
00:40:06,338 --> 00:40:11,528
of the mission and so that also ties

989
00:40:09,190 --> 00:40:13,958
into that water vapor paper because they

990
00:40:11,528 --> 00:40:15,699
found a strong dependence on distance

991
00:40:13,958 --> 00:40:17,259
from the Sun and the closer they were to

992
00:40:15,699 --> 00:40:19,180
the Sun they saw the water vapor and the

993
00:40:17,259 --> 00:40:20,829
further they were away they didn't see

994
00:40:19,179 --> 00:40:24,190
it that was the personal observations

995
00:40:20,829 --> 00:40:27,039
right yeah yes when we're getting to

996
00:40:24,190 --> 00:40:29,708
Ceres it's past that point already and

997
00:40:27,039 --> 00:40:32,259
it's only going further away so it'll be

998

00:40:29,708 --> 00:40:34,748
very interesting to see if we see it and

999
00:40:32,259 --> 00:40:40,568
we don't know if we will or not but

1000
00:40:34,748 --> 00:40:44,498
we're definitely gonna look for it so by

1001
00:40:40,568 --> 00:40:46,690
all means yeah so Herschel Herschel hojo

1002
00:40:44,498 --> 00:40:48,608
observed the the water vapor around

1003
00:40:46,690 --> 00:40:52,838
Ceres but right now there's only one

1004
00:40:48,608 --> 00:40:54,518
child appellation so one one people were

1005
00:40:52,838 --> 00:40:56,259
thinking what what what could be the

1006
00:40:54,518 --> 00:40:58,868
possible reason for that sublimation and

1007
00:40:56,259 --> 00:41:00,190
one reason is like comment you know when

1008
00:40:58,869 --> 00:41:01,989
they get close to the sound they

1009
00:41:00,190 --> 00:41:04,088
sublimate when they get away they don't

1010
00:41:01,989 --> 00:41:06,190
sublimate and if this is the case for

1011
00:41:04,088 --> 00:41:08,318
series then you know by the time that

1012
00:41:06,190 --> 00:41:09,849

Tonga series and around series and

1013

00:41:08,318 --> 00:41:12,429
series is quite powerful far away from

1014

00:41:09,849 --> 00:41:15,249
the Sun actually it's near its scaling

1015

00:41:12,429 --> 00:41:18,009
is going to it's it's appealing so in

1016

00:41:15,248 --> 00:41:20,048
that case we may not expect much water

1017

00:41:18,009 --> 00:41:21,670
vapor around Ceres however there are

1018

00:41:20,048 --> 00:41:23,588
other scenarios that can make water

1019

00:41:21,670 --> 00:41:27,190
vapor like you know like what's

1020

00:41:23,588 --> 00:41:30,099
happening for what what's happening for

1021

00:41:27,190 --> 00:41:32,619
like organism if it's if if there's some

1022

00:41:30,099 --> 00:41:35,289
kind of internal heating you know then

1023

00:41:32,619 --> 00:41:36,789
that drives out water then since this is

1024

00:41:35,289 --> 00:41:39,130
the internal heating it does not depend

1025

00:41:36,789 --> 00:41:42,160
on water depending on does not depend on

1026

00:41:39,130 --> 00:41:44,920
solar heating a lot so this will have

1027
00:41:42,159 --> 00:41:47,348
weak dependence on a distance of series

1028
00:41:44,920 --> 00:41:48,729
with with the Sun so if this is the case

1029
00:41:47,349 --> 00:41:50,949
then we might be able to see something

1030
00:41:48,728 --> 00:41:53,169
so that's why you know there's a

1031
00:41:50,949 --> 00:41:55,809
actually tone has another you know right

1032
00:41:53,170 --> 00:41:59,199
now this also are also one of Don's

1033
00:41:55,809 --> 00:42:01,749
tasks try to see what it what water in

1034
00:41:59,199 --> 00:42:04,088
series is really like and how much water

1035
00:42:01,748 --> 00:42:07,358
does it have really forty percent or we

1036
00:42:04,088 --> 00:42:09,579
are wrong before and also where are this

1037
00:42:07,358 --> 00:42:11,920
water you know are they very deep

1038
00:42:09,579 --> 00:42:13,360
inside the surface inside the curio or

1039
00:42:11,920 --> 00:42:16,180
they are very close to the surface and

1040
00:42:13,360 --> 00:42:18,910
also what kind of activity are there so

1041
00:42:16,179 --> 00:42:20,769
by observing you know water whether

1042
00:42:18,909 --> 00:42:22,289
there's any ice on the surface or you

1043
00:42:20,769 --> 00:42:24,369
know very shallow beneath the surface

1044
00:42:22,289 --> 00:42:26,769
we're actually trying to answer this

1045
00:42:24,369 --> 00:42:28,420
question - great man you guys are asking

1046
00:42:26,769 --> 00:42:30,880
some great questions I'm just gonna keep

1047
00:42:28,420 --> 00:42:34,960
going here I like this one

1048
00:42:30,880 --> 00:42:38,440
Jorge Lima on Q&A app is asking hi

1049
00:42:34,960 --> 00:42:41,079
Rosetta analysis on the comet 67p water

1050
00:42:38,440 --> 00:42:44,019
showed that it's different than the

1051
00:42:41,079 --> 00:42:46,659
water on earth I did not know that will

1052
00:42:44,019 --> 00:42:51,579
dawn also makes a similar analysis on

1053
00:42:46,659 --> 00:42:55,179
Ceres water that is a good question

1054
00:42:51,579 --> 00:42:57,670
so our grand instrument does elemental

1055

00:42:55,179 --> 00:43:00,210
composition but it can only see a little

1056
00:42:57,670 --> 00:43:03,309
bit into the surface so if this water is

1057
00:43:00,210 --> 00:43:07,780
too low below the surface it's not going

1058
00:43:03,309 --> 00:43:09,130
to be able to see the water so it's

1059
00:43:07,780 --> 00:43:11,890
really going to depend on close the

1060
00:43:09,130 --> 00:43:14,650
water is to the surface and the ability

1061
00:43:11,889 --> 00:43:16,269
of our instruments to see it okay so the

1062
00:43:14,650 --> 00:43:18,910
good question that is interesting so

1063
00:43:16,269 --> 00:43:20,860
would then I think it's what van der

1064
00:43:18,909 --> 00:43:23,529
Heide I'm sorry if I'm messing up the

1065
00:43:20,860 --> 00:43:25,420
pronunciation this is also Q&A app and

1066
00:43:23,530 --> 00:43:27,130
this is I guess it's timely since we've

1067
00:43:25,420 --> 00:43:30,880
talked about this for most of the hour

1068
00:43:27,130 --> 00:43:33,280
how will the NASA dawn mission end after

1069
00:43:30,880 --> 00:43:36,280

studying Siri series will the probe just

1070

00:43:33,280 --> 00:43:38,170

send will just be sent in a trajectory

1071

00:43:36,280 --> 00:43:40,930

outside our solar system will it keep

1072

00:43:38,170 --> 00:43:42,909

orbiting series or can we can we try a

1073

00:43:40,929 --> 00:43:45,969

soft landing on Ceres like the one

1074

00:43:42,909 --> 00:43:48,789

that's being considered with Rosetta so

1075

00:43:45,969 --> 00:43:50,500

the plan with Don at the end is that we

1076

00:43:48,789 --> 00:43:53,920

will stay on our lowest orbit the low

1077

00:43:50,500 --> 00:43:55,570

altitude mapping orbit for cover and the

1078

00:43:53,920 --> 00:43:57,720

reason that we don't want to touch Ceres

1079

00:43:55,570 --> 00:43:59,950

is because of all of that water and

1080

00:43:57,719 --> 00:44:01,419

there's this thing called planetary

1081

00:43:59,949 --> 00:44:03,399

protection that we don't want to

1082

00:44:01,420 --> 00:44:07,659

interfere and touch any water

1083

00:44:03,400 --> 00:44:10,840

I'm directive yes basically so we want

1084
00:44:07,659 --> 00:44:12,819
to basically stay safe and stay in our

1085
00:44:10,840 --> 00:44:15,730
orbit and just kind of orbit series so

1086
00:44:12,820 --> 00:44:19,539
via a lonely moon orbiting series

1087
00:44:15,730 --> 00:44:22,630
forever that's kind of a nice image

1088
00:44:19,539 --> 00:44:23,349
though but you know sorry Tony one thing

1089
00:44:22,630 --> 00:44:25,300
I learned a while

1090
00:44:23,349 --> 00:44:27,639
which I was surprised to hear is that

1091
00:44:25,300 --> 00:44:29,980
apparently early on there was a chance

1092
00:44:27,639 --> 00:44:32,619
that Don could go to the large asteroid

1093
00:44:29,980 --> 00:44:34,750
Pallas after series but I guess because

1094
00:44:32,619 --> 00:44:37,210
of launch delays that that opportunity

1095
00:44:34,750 --> 00:44:39,849
was lost and so I just it's

1096
00:44:37,210 --> 00:44:42,130
heartbreaking you know to hear that but

1097
00:44:39,849 --> 00:44:43,630
it does make you realize as Kerry was

1098
00:44:42,130 --> 00:44:45,160
describing at the beginning you know

1099
00:44:43,630 --> 00:44:47,200
that I guess there's always you know

1100
00:44:45,159 --> 00:44:49,779
even if you stay in sort of a stable

1101
00:44:47,199 --> 00:44:51,250
orbit for even a decade you know is

1102
00:44:49,780 --> 00:44:53,920
there a possibility that if there's

1103
00:44:51,250 --> 00:44:55,539
funding and an object to go to that you

1104
00:44:53,920 --> 00:44:57,309
could you know flip the switches back on

1105
00:44:55,539 --> 00:44:59,199
and say okay we're leaving Ceres orbit

1106
00:44:57,309 --> 00:45:00,429
and going to another object or is it

1107
00:44:59,199 --> 00:45:05,019
just that there's no really interesting

1108
00:45:00,429 --> 00:45:07,269
objects you know within reach yet I

1109
00:45:05,019 --> 00:45:09,250
don't know yet another advantage of on

1110
00:45:07,269 --> 00:45:10,539
Drive is that possible carry can can

1111
00:45:09,250 --> 00:45:16,929
they just do that if they decide there's

1112

00:45:10,539 --> 00:45:18,429
something else to look at do you know we

1113
00:45:16,929 --> 00:45:19,869
didn't catch that that all head out for

1114
00:45:18,429 --> 00:45:22,059
a second molar sorry is that is that

1115
00:45:19,869 --> 00:45:23,529
true that that you know you can maybe

1116
00:45:22,059 --> 00:45:24,670
just after if you see something else

1117
00:45:23,530 --> 00:45:27,250
interesting you can just turn on the

1118
00:45:24,670 --> 00:45:29,710
drives and it still does it remain

1119
00:45:27,250 --> 00:45:35,650
possible to depart series ever in the

1120
00:45:29,710 --> 00:45:37,990
future yeah that's a good play the

1121
00:45:35,650 --> 00:45:41,200
reason that we will not depart series is

1122
00:45:37,989 --> 00:45:44,889
because we had two of our four reaction

1123
00:45:41,199 --> 00:45:47,139
wheel almost fail and so to turn we have

1124
00:45:44,889 --> 00:45:49,569
to use also our hydrazine thrusters in

1125
00:45:47,139 --> 00:45:53,289
addition to our reaction wheels and so

1126
00:45:49,570 --> 00:45:55,240

for us to stay there we're really gonna

1127

00:45:53,289 --> 00:45:56,800

we wanted to make sure we got serious

1128

00:45:55,239 --> 00:45:59,109

done and that's basically going to use

1129

00:45:56,800 --> 00:46:00,519

up the rest of our resources so we won't

1130

00:45:59,110 --> 00:46:03,309

be able to turn anymore and if we can't

1131

00:46:00,519 --> 00:46:04,960

turn then we can't turn to send all of

1132

00:46:03,309 --> 00:46:07,029

those pictures back and we can't turn to

1133

00:46:04,960 --> 00:46:09,820

take the pictures I swear reaction

1134

00:46:07,030 --> 00:46:12,130

wheels and awesome missions are just

1135

00:46:09,820 --> 00:46:14,140

going hand-in-hand with not going well

1136

00:46:12,130 --> 00:46:16,059

we need to find a better I know these

1137

00:46:14,139 --> 00:46:18,549

these reaction we all seem to be there

1138

00:46:16,059 --> 00:46:20,920

with Achilles heel of most most missions

1139

00:46:18,550 --> 00:46:22,480

these days but that is a neat idea max

1140

00:46:20,920 --> 00:46:26,110

that would be cool if they could if they

1141
00:46:22,480 --> 00:46:27,490
could do that okay so finally let me

1142
00:46:26,110 --> 00:46:32,200
just okay I'm gonna go over here and

1143
00:46:27,489 --> 00:46:34,000
look at my youtube okay so we just

1144
00:46:32,199 --> 00:46:36,799
here's one from Enrico Gatto from

1145
00:46:34,000 --> 00:46:39,440
YouTube I'll just put this up real quick

1146
00:46:36,800 --> 00:46:41,720
is dawn going to visit any other body of

1147
00:46:39,440 --> 00:46:43,429
the solar system after series Kerry just

1148
00:46:41,719 --> 00:46:50,029
answered that sounds like we're it's not

1149
00:46:43,429 --> 00:46:52,730
going to go anywhere so and let me see

1150
00:46:50,030 --> 00:46:55,730
cage crave on YouTube can you point your

1151
00:46:52,730 --> 00:46:59,389
telescope on our binary Dark Star

1152
00:46:55,730 --> 00:47:01,969
companion I don't know what that the

1153
00:46:59,389 --> 00:47:03,799
darks Arkham yeah yeah that's like with

1154
00:47:01,969 --> 00:47:05,929
the red matter from Star Trek and I

1155
00:47:03,800 --> 00:47:09,940
think we can just go along okay okay

1156
00:47:05,929 --> 00:47:15,559
yeah yeah so there we go okay so that's

1157
00:47:09,940 --> 00:47:16,880
yeah thank you YouTube sorry this is

1158
00:47:15,559 --> 00:47:20,449
what I get for not having a director

1159
00:47:16,880 --> 00:47:21,860
write down today so okay so I think that

1160
00:47:20,449 --> 00:47:24,289
do I have any is there anything from

1161
00:47:21,860 --> 00:47:26,360
Twitter Scott that I'm missing oh I've

1162
00:47:24,289 --> 00:47:27,949
been trying to monitor Twitter there's

1163
00:47:26,360 --> 00:47:31,579
been a lot going on first of all I do

1164
00:47:27,949 --> 00:47:34,339
want to give a shout out to the the the

1165
00:47:31,579 --> 00:47:37,250
dawn EP team they've been great with

1166
00:47:34,340 --> 00:47:39,289
with tweeting out as everything's going

1167
00:47:37,250 --> 00:47:42,260
on and interacting with everyone there

1168
00:47:39,289 --> 00:47:44,840
but people are having just some great

1169

00:47:42,260 --> 00:47:47,420
conversations about the amazing images

1170
00:47:44,840 --> 00:47:49,850
that have been going on and sharing out

1171
00:47:47,420 --> 00:47:52,909
our show so we really love that and all

1172
00:47:49,849 --> 00:47:54,500
the great great tweets and the love of

1173
00:47:52,909 --> 00:47:56,799
the images that we've been sending out

1174
00:47:54,500 --> 00:47:59,000
to so I've been tweeting out as as

1175
00:47:56,800 --> 00:48:00,350
Hubble of the different images we're

1176
00:47:59,000 --> 00:48:02,030
going out there so there's been a lot of

1177
00:48:00,349 --> 00:48:03,860
great stuff I'm gonna head over to the

1178
00:48:02,030 --> 00:48:05,660
event page and see what else we have

1179
00:48:03,860 --> 00:48:06,559
going on the event page okay yeah check

1180
00:48:05,659 --> 00:48:08,210
it out and let me know if you see

1181
00:48:06,559 --> 00:48:11,150
anything max I'd like to ask you a quick

1182
00:48:08,210 --> 00:48:14,360
question about is there any future role

1183
00:48:11,150 --> 00:48:18,019

or any plans with Hubble that you know

1184

00:48:14,360 --> 00:48:19,910

of - maybe observe series in conjunction

1185

00:48:18,019 --> 00:48:22,219

with dawn or is Hubble pretty much done

1186

00:48:19,909 --> 00:48:25,129

for now with its with its participation

1187

00:48:22,219 --> 00:48:26,869

do you happen to know well you know

1188

00:48:25,130 --> 00:48:30,140

there is some data that we're working on

1189

00:48:26,869 --> 00:48:32,659

right now I mean you know there's been

1190

00:48:30,139 --> 00:48:34,339

some observations last spring and one of

1191

00:48:32,659 --> 00:48:36,589

the things we've done for dawn for both

1192

00:48:34,340 --> 00:48:39,019

Vesta and Ceres a search for moons and

1193

00:48:36,590 --> 00:48:40,579

we're still working on that I think are

1194

00:48:39,019 --> 00:48:41,960

but you know of course now the dawn

1195

00:48:40,579 --> 00:48:43,489

spacecraft is going to be able to do

1196

00:48:41,960 --> 00:48:44,920

that even better so but it's all you

1197

00:48:43,489 --> 00:48:46,669

know the same people who've been using

1198
00:48:44,920 --> 00:48:49,190
Hubble and now I think we're

1199
00:48:46,670 --> 00:48:50,690
transitioning to a moon search with the

1200
00:48:49,190 --> 00:48:54,380
dawn spacecraft does it a pro

1201
00:48:50,690 --> 00:48:57,289
so just before it goes into orbit early

1202
00:48:54,380 --> 00:49:00,079
next year and so we're still you know

1203
00:48:57,289 --> 00:49:01,550
still working on that problem you know

1204
00:49:00,079 --> 00:49:03,349
we've done many searches so I think if

1205
00:49:01,550 --> 00:49:05,120
series had a big moon we'd know it by

1206
00:49:03,349 --> 00:49:07,309
now you know right we're kind of like

1207
00:49:05,119 --> 00:49:08,619
scratching in the dirt now to try to see

1208
00:49:07,309 --> 00:49:14,299
if there could be a small satellite

1209
00:49:08,619 --> 00:49:16,219
around Ceres so and I think depending on

1210
00:49:14,300 --> 00:49:19,130
what happens you know I know with

1211
00:49:16,219 --> 00:49:22,329
discoveries of dōnitz series there could

1212
00:49:19,130 --> 00:49:24,380
be some kind of follow-up or some

1213
00:49:22,329 --> 00:49:26,509
complementary observations that could be

1214
00:49:24,380 --> 00:49:28,190
done with Hubble possibly I think it

1215
00:49:26,510 --> 00:49:34,360
remains to be seen but it would be

1216
00:49:28,190 --> 00:49:34,360
driven by discoveries at Ceres okay all

1217
00:49:41,469 --> 00:49:47,569
right I believe Jane that you'll be

1218
00:49:44,300 --> 00:49:51,380
still observing series from Hubble quite

1219
00:49:47,570 --> 00:49:54,710
a long time right well we actually have

1220
00:49:51,380 --> 00:49:56,930
another observation from both one series

1221
00:49:54,710 --> 00:50:00,170
which will be next year yeah next year

1222
00:49:56,929 --> 00:50:02,719
in June and that is actually in a UV

1223
00:50:00,170 --> 00:50:04,460
because you know Tom does not don't mean

1224
00:50:02,719 --> 00:50:06,259
Tony instrument is not sensitive to UV

1225
00:50:04,460 --> 00:50:08,570
wavelength which is you know do we work

1226

00:50:06,260 --> 00:50:12,350
with UV is what with everybody doesn't

1227
00:50:08,570 --> 00:50:15,680
like and so you cannot do that from one

1228
00:50:12,349 --> 00:50:18,199
everybody just like yeah yeah because

1229
00:50:15,679 --> 00:50:25,489
everybody use some blockers to block it

1230
00:50:18,199 --> 00:50:27,919
oh you want see anything in the UV from

1231
00:50:25,489 --> 00:50:30,500
a space telescope couples the only game

1232
00:50:27,920 --> 00:50:32,090
in town there's the only actually

1233
00:50:30,500 --> 00:50:34,070
actually you cannot do that from the

1234
00:50:32,090 --> 00:50:35,660
ground just because our atmosphere

1235
00:50:34,070 --> 00:50:38,110
actually blocks a lot of beauty already

1236
00:50:35,659 --> 00:50:41,960
so we cannot do that on the ground and

1237
00:50:38,110 --> 00:50:44,769
instrument yeah and so that's why we're

1238
00:50:41,960 --> 00:50:47,119
good there's a good question from

1239
00:50:44,769 --> 00:50:50,059
there's a good question here from the

1240
00:50:47,119 --> 00:50:52,190

Google+ event page which might cause a

1241

00:50:50,059 --> 00:50:55,730

minor fight to break out here at Jet

1242

00:50:52,190 --> 00:50:57,590

Propulsion Laboratory is if significant

1243

00:50:55,730 --> 00:50:59,900

water is detected on Ceres with that

1244

00:50:57,590 --> 00:51:03,110

minor planet or planet become as

1245

00:50:59,900 --> 00:51:04,280

important as Mars is now for NASA in the

1246

00:51:03,110 --> 00:51:07,250

future

1247

00:51:04,280 --> 00:51:10,160

I'm sure that could cause a fight here

1248

00:51:07,250 --> 00:51:11,510

on these grounds but I'm not sure to

1249

00:51:10,159 --> 00:51:12,949

hear what you have to say about that

1250

00:51:11,510 --> 00:51:15,890

then I'll talk with our Marsh friends

1251

00:51:12,949 --> 00:51:18,500

afterwards so we're not in competition

1252

00:51:15,889 --> 00:51:23,049

we're all one big happy family here at

1253

00:51:18,500 --> 00:51:26,960

NASA and so you know it's really up to

1254

00:51:23,050 --> 00:51:29,030

the scientists and Congress to identify

1255
00:51:26,960 --> 00:51:31,519
the priorities and come up with the

1256
00:51:29,030 --> 00:51:33,140
budget for it and and that's one thing

1257
00:51:31,519 --> 00:51:35,210
that's always great to do is rely on

1258
00:51:33,139 --> 00:51:38,500
Congress to make great decisions for

1259
00:51:35,210 --> 00:51:41,090
it's for science quickly that's right I

1260
00:51:38,500 --> 00:51:43,070
just want to say the opinions expressed

1261
00:51:41,090 --> 00:51:48,858
by Scott Lewis are his own and I have an

1262
00:51:43,070 --> 00:51:50,210
independent contractor all right this

1263
00:51:48,858 --> 00:51:51,889
has been awesome well I will say one

1264
00:51:50,210 --> 00:51:53,179
thing we've had a lot of live viewers on

1265
00:51:51,889 --> 00:51:55,460
this hangout it's been really great

1266
00:51:53,179 --> 00:51:57,139
having you guys there I'm still oh

1267
00:51:55,460 --> 00:51:57,740
here's one from zigzag them you get to

1268
00:51:57,139 --> 00:52:00,049
that real quick

1269
00:51:57,739 --> 00:52:02,689
does series have a gravity and

1270
00:52:00,050 --> 00:52:04,640
atmosphere also any indications of ice

1271
00:52:02,690 --> 00:52:07,280
on the surface gas emissions coming from

1272
00:52:04,639 --> 00:52:09,529
Ceres we've answered some of that that

1273
00:52:07,280 --> 00:52:11,690
does have gravity you can be sure of

1274
00:52:09,530 --> 00:52:14,240
that and Kerry mentioned something about

1275
00:52:11,690 --> 00:52:15,980
atmospheres and is there any indications

1276
00:52:14,239 --> 00:52:20,539
of ice on the surface are we sure of any

1277
00:52:15,980 --> 00:52:23,809
ice on the surface guys no okay now yeah

1278
00:52:20,539 --> 00:52:25,489
well maybe not yet right no exactly we

1279
00:52:23,809 --> 00:52:27,019
get those pictures from from dawn to

1280
00:52:25,489 --> 00:52:35,449
find that out and as far as we know no

1281
00:52:27,019 --> 00:52:37,099
gas emissions show that there there

1282
00:52:35,449 --> 00:52:39,588
might be some water vapor I mean they

1283

00:52:37,099 --> 00:52:42,680
are some water vapor entities but very

1284
00:52:39,588 --> 00:52:45,380
very moment so there you go good

1285
00:52:42,679 --> 00:52:50,598
question zigzag thank you very much okay

1286
00:52:45,380 --> 00:52:52,220
so let's see I guess some I I'm trying

1287
00:52:50,599 --> 00:52:54,559
to see if I'm missing anything Scott can

1288
00:52:52,219 --> 00:52:56,719
you tell me one more time if you see

1289
00:52:54,559 --> 00:52:58,880
anything now I think we've got them on

1290
00:52:56,719 --> 00:53:00,679
we we don't a few things to mention as

1291
00:52:58,880 --> 00:53:03,680
far as you know since this is our first

1292
00:53:00,679 --> 00:53:07,069
really big which I'm really happy to be

1293
00:53:03,679 --> 00:53:09,739
a part of a collaborative Hubble hang

1294
00:53:07,070 --> 00:53:11,210
out with other science missions do you

1295
00:53:09,739 --> 00:53:13,729
want to do a quick shout out again to

1296
00:53:11,210 --> 00:53:15,980
everyone at the the dawn team including

1297
00:53:13,730 --> 00:53:17,510

Kerry whom I just happen to be friends

1298

00:53:15,980 --> 00:53:20,389
with but everyone else

1299

00:53:17,510 --> 00:53:22,910
at the dawn team the science team the

1300

00:53:20,389 --> 00:53:25,579
outreach team there is an event coming

1301

00:53:22,909 --> 00:53:28,909
up on the 9th of May of next year called

1302

00:53:25,579 --> 00:53:30,559
ic series there's a link down here and

1303

00:53:28,909 --> 00:53:34,190
I'll put this into the event page but

1304

00:53:30,559 --> 00:53:37,489
it's a bitly link dawn underscored by

1305

00:53:34,190 --> 00:53:39,050
the letter C series and you can find out

1306

00:53:37,489 --> 00:53:41,539
more about what's going on that will be

1307

00:53:39,050 --> 00:53:45,140
here in Cal Tech but people can start up

1308

00:53:41,539 --> 00:53:48,829
their own private events across the

1309

00:53:45,139 --> 00:53:51,170
world and I might actually be attending

1310

00:53:48,829 --> 00:53:53,239
that too here for different reasons but

1311

00:53:51,170 --> 00:53:56,420
it's something that's there's a lot of

1312
00:53:53,239 --> 00:53:58,429
things going on with with dawn and I

1313
00:53:56,420 --> 00:54:01,420
definitely recommend going to the dawn

1314
00:53:58,429 --> 00:54:05,480
website which can be found where dawn

1315
00:54:01,420 --> 00:54:07,159
JPL nasa.gov very nicely done very well

1316
00:54:05,480 --> 00:54:09,679
done and I I just want to echo what

1317
00:54:07,159 --> 00:54:11,389
Scott said I am happy to be working with

1318
00:54:09,679 --> 00:54:13,339
other NASA missions to the extent that

1319
00:54:11,389 --> 00:54:15,379
we that Hubble is able to contribute to

1320
00:54:13,340 --> 00:54:17,630
their their science I really want to do

1321
00:54:15,380 --> 00:54:25,210
more of these Kari can we have you back

1322
00:54:17,630 --> 00:54:25,210
when when we get close to Ceres hello

1323
00:54:25,659 --> 00:54:31,219
you froze so Kari can you do something

1324
00:54:28,550 --> 00:54:33,769
with series I think can we have her back

1325
00:54:31,219 --> 00:54:35,569
when we tell us when we get closer when

1326
00:54:33,769 --> 00:54:40,099
we get closer this early maybe sometime

1327
00:54:35,570 --> 00:54:42,710
early next year yeah and so we will have

1328
00:54:40,099 --> 00:54:45,858
we will enter our first science orbit at

1329
00:54:42,710 --> 00:54:48,920
the end of April so we will start having

1330
00:54:45,858 --> 00:54:51,259
some fantastic images at that point good

1331
00:54:48,920 --> 00:54:52,820
I hope to have you guys back and John

1332
00:54:51,260 --> 00:54:54,410
yang and max I want to thank you both

1333
00:54:52,820 --> 00:54:55,700
for giving us the Hubble contributions

1334
00:54:54,409 --> 00:54:58,039
it was really wonderful having you back

1335
00:54:55,699 --> 00:54:59,779
as always I enjoy having you in my

1336
00:54:58,039 --> 00:55:01,570
hangouts you're always really great so

1337
00:54:59,780 --> 00:55:03,769
thank you both for showing up and

1338
00:55:01,570 --> 00:55:05,420
contributing I appreciate it you hope to

1339
00:55:03,769 --> 00:55:06,619
you'll come back and join us again for

1340

00:55:05,420 --> 00:55:10,849
future ones maybe we would do some

1341
00:55:06,619 --> 00:55:12,619
common stuff who knows next week we're

1342
00:55:10,849 --> 00:55:15,019
going to have we're going to be going to

1343
00:55:12,619 --> 00:55:16,789
the intrepid museum in New York where

1344
00:55:15,019 --> 00:55:19,159
they are having the Hubble 20 double at

1345
00:55:16,789 --> 00:55:21,170
25 exhibit we'll have astronaut Mike

1346
00:55:19,159 --> 00:55:23,089
Massimino with us he will talk to us not

1347
00:55:21,170 --> 00:55:25,670
only about the exhibit but about being a

1348
00:55:23,090 --> 00:55:27,858
Space Shuttle astronaut about all the

1349
00:55:25,670 --> 00:55:29,510
experiences with Hubble he was also one

1350
00:55:27,858 --> 00:55:30,989
of the ones that worked on Hubble so he

1351
00:55:29,510 --> 00:55:32,760
can give us some

1352
00:55:30,989 --> 00:55:35,309
ground on that so that will be next week

1353
00:55:32,760 --> 00:55:37,650
at our regular time I am so excited

1354
00:55:35,309 --> 00:55:40,829

about that yeah me too

1355

00:55:37,650 --> 00:55:42,358

I when we when that was first told me

1356

00:55:40,829 --> 00:55:45,509

that we were gonna have that I kind of

1357

00:55:42,358 --> 00:55:47,009

squeeze okay I really squeezed I was

1358

00:55:45,510 --> 00:55:49,710

really excited that we'll be able to

1359

00:55:47,010 --> 00:55:52,349

talk to one of the only human beings

1360

00:55:49,710 --> 00:55:54,030

that a man in space that has worked on

1361

00:55:52,349 --> 00:55:55,588

the telescope that we get to talk about

1362

00:55:54,030 --> 00:55:57,780

every single week so it's really cool

1363

00:55:55,588 --> 00:55:59,009

yeah so as Scott mentioned I want to

1364

00:55:57,780 --> 00:56:00,869

thank everybody from the NASA Dawn

1365

00:55:59,010 --> 00:56:02,820

mission I want to thank you Carrie max

1366

00:56:00,869 --> 00:56:03,240

and John yang for for taking time out to

1367

00:56:02,820 --> 00:56:05,010

do it

1368

00:56:03,239 --> 00:56:06,479

Carol we'll be back next week she

1369
00:56:05,010 --> 00:56:09,119
couldn't make it because of the time

1370
00:56:06,480 --> 00:56:10,710
change the time difference she couldn't

1371
00:56:09,119 --> 00:56:13,440
she couldn't attend this week but she

1372
00:56:10,710 --> 00:56:14,699
will also be back next week and so thank

1373
00:56:13,440 --> 00:56:16,470
you all for watching thank you for

1374
00:56:14,699 --> 00:56:20,338
commenting thank you for questioning and

1375
00:56:16,469 --> 00:56:23,629
as always keep looking up there you go

1376
00:56:20,338 --> 00:56:23,630
talk to you guys later